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This monograph contains the second section, operations at the variable level, of a report of studies done in Helsinki, Finland, describing school achievement in terms of ability, trait, situational, and background variables. The report (1) investigates the structure of school achievement, (2) describes school achievement in terms of selected personality variables, and (3) applies multidimensional statistical operations in situations where it is considered desirable to reduce the number of dimensions and describe a set of dependent variables in terms of a set of independent variables in a single operation. Part II gives an account of the construction and psychometric properties of the variables. Information provided by correlation coefficients, factor analyses, congruence coefficients, and canonical analyses are employed to describe school achievement in terms of the personality variables of the study. Invariance of empirical dimensions is studied through transformation analysis and the congruence coefficients of factors. Results suggest separate statistical treatment of boys and girls. Canonical analysis shows that new solutions concerning the bases of this type of operations should be sought. (BP)

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SCHOOL ACHIEVEMENT AND PERSONALITY

Description of School Achievement in Terms of Ability, Trait, Situational and Background Variables

II: Operations at the Variable Level

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Plan of This Study

The following four parts of my studies on school achievement will be published in succession:

SCHOOL ACHIEVEMENT AND PERSONALITY

Description of School Achievement in Terms of Ability, Trait, Situational and Background Variables

I: Design and Hypotheses

IV: Results and Discussion

These parts are published as No. 21, Research Bulletin, Institute of Education, University of Helsinki.

II: Operations at the Variable Level

This part is included in this monograph.

III: Operations at the Factor Level

This part is published as No. 23, Research Bulletin, Institute of Education, University of Helsinki.

Part II, Operations at the Variable Level, presents the construction of variables and the mathematical and statistical operations performed at the variable level. This part deals with the construction of the variables used in the study, their psychometric properties, the combination of dimensions, and the mathematical and statistical operations performed. A multitude of operations is necessary, since the number of variables is comparatively large. In the study situation, an average of 570 test stimuli were administred to each subject; and, in addition, each subject was rated in 30 traits. Thus, the number of observational dimensions is about 600 in the initial situation. Therefore, a great many dimension combination operations are presented in this part, which is, in consequence, largely method-centred, and also includes a description and appraisal of the analysis models employed. The information obtained will be discussed in Part IV on the basis of the hypotheses; in Part II, only an account is given of the nature of the information yielded by each of the operations performed.

The approach followed in the study is such that an attempt is made to describe school achievement in terms of the other variables chosen for the study; or, in other words, the other variables will be made to account for the variance of school achievement.This approach can be illustrated,in terms of matrices, by the following schematic representation. This matrix scheme also provides an opportunity foran analysis in terms of the matrix elements or vectors.

$$\begin{bmatrix} (\text{intelligence}) \\ (\text{shaping dexterity}) \\ (\text{persuasibility}) \\ \left(\begin{array}{l}\text{pupils' traits as} \\ \text{rated by teacher}\end{array}\right) \\ (\text{attitudes}) \\ (\text{sociometric variables}) \\ (\text{social status}) \\ (\text{number of siblings}) \end{bmatrix} \longrightarrow \begin{bmatrix} \text{school marks} \end{bmatrix}$$

1. Summary

The series of studies on school achievement reported here is concerned with the following three problem areas:

1. investigation of the structure of school achievement
2. description of school achievement in terms of selected personality variables
3. application of multidimensional statistical operations in situations where it is considered desirable to reduce the number of dimensions and to describe a set of dependent variables in terms of a set of independent variables in a single operation.

The present Part II, entitled Operations at the Variable Level, is method-centred.

Citizenship school pupils (compulsory school years 7 and 8) served as subjects in the study;the sample of subjects included 97-87 girls and 80-70 boys.

This part gives an account of the construction and psychometric properties of the variables.

Five interpretable school achievement factors were obtained for each group of subjects (a girl group, a boy group and a combined group).

The information provided by correlation coefficients, factor analyses,congruence coefficients and canonical analyses can be employed to describe school achievement in terms of the personality variables included in the study.The content of this information is presented in Part IV of the study.

The invariance of the empirical dimensions was studied through a transformation analysis model and by means of the congruence coefficients of factors.The results of a comparative analysis of the dimensions obtained suggest that the girl and boy groups should be treated separately in subsequent operations.

The operations of canonical analysis showed that, in order to reduce the harmful influence of multicollinearity, new solutions concerning the foundations of this type of operations should be sought.Also, the interpretation of the results can be simplified through reducing the degree of internal interdependence in the matrices forming the starting-point for canonical analysis.

Preliminary analyses necessary for the factor-level operations are included in the present Part II.

2. The Subjects

Not only the problems to be investigated and the formation of the school achievement variables but also the information available on the factors influencing the variances of the variables to be studied, in combination with certain practical considerations, guided the selection of subjects for the study.

Particularly the attitudinal and persuasibility variables had a bearing on the selection of subjects. Previous studies have shown that age, ecological factors, the school type and the field of study are associated with attitudinal differences (Johannesson & Magnusson 1960; Swedner 1960; Takala & Niskanen 1963; and Henricson 1961). Studies on the influence of communication have also revealed inter-group differences: Thurstone (1959) found differences between towns and countryside, and the Yale team has demonstrated differences associated with age and differences between deviate and normal groups. Schramm (1962) has also reported differences between various groups. What was known about the factors affecting the variances of attitudinal and persuasibility variables suggested the use of an as nearly homogeneous group of subjects as possible. This choice was supported by the fact that the elimination of attitudinal differences is one of the methodological problems inherent in the measurement of persuasibility.

The selection of subjects was also co-determined by certain practical considerations. The measurements, information and judgments took place over a period of two years, on a number of dates, and an entire school-class was subjected to study on each occasion. Therefore, the town of Jyväskylä, where the writer was resident, was chosen as the place of the study. Certain measurement situations, e.g., the giving of information in the measurement of persuasibility, presupposed the use of a single experimenter, and this limited the size of the group of subjects. The research design, on the other hand, presupposed the use of a large number of variables. Thus, a large number of variables rather than a large number of subjects was employed to increase the number of observations. The boys and girls attending the citizenship school (compulsory school, years 7 and 8) of Jyväskylä who began their seventh-grade studies in the autumn of 1961 were chosen as the subjects. All seventh-grade classes (N=8) were included, except two classes, which were used in pre-experiments, and one, which served as a control class. Initially the subjects totalled 230. The group diminished considerably over the two years during which the measurements were performed. Only the pupils who were present in all the requisite tests and for whom the results on the tests of the Vocational Guidance Office and teachers' ratings were available were included in the present study. The results to be reported here relate to 177, 165 or 157 pupils. Boys and girls were approximately equal in numbers. The reasons for exclusion, which were many and varied, will not be presented in this report.

3. The Variables

Only a part of information will be given here about the variables and their properties, the whole of information is available in The Department of Education. The way in which the variables were established and the principles followed in investigating them will be considered in greater detail. The variables will be presented in the following order: the school achievement variables, the intelligence variables, the persuasibility variables, the attitudinal variables, the sociometric variables, the trait variables as rated by teachers, the dexterity variables,social status, and the number of siblings.

3.1. The School Achievement Variables

The school marks were employed as the measures of school achievement. To increase the variances of school marks and to improve their distributions and increase their reliability, the mean of the marks in the spring reports for the seventh and eighth grades was used as the final variable for each particular school subject, though these reports are of different value. Only the subjects taught to all pupils were included. The group of skill subjects remained small, and therefore the mark for penmanship in the report for the sixth grade was also included. This inclusion seemed legitimate in the light of previous factor studies (Heinonen 1964; Henrysson 1960). The school subjects are listed in the correlation matrix (Tables 1-3). The number of the lessons in each subject is listed in the appendix.

Numerous problems are inherent in the estimation of the reliability of school marks variables. Theoretical knowledge about the factors affecting pupil evaluation, various statistical techniques for computing reliability indexes and empirical knowledge of variance components and school achievement dimensions are available for estimating reliability (Vahervuo 1958; Gronlund 1965; Koort 1959, 1960 and 1964; Heinonen 1960 and 1964; Cavonius 1961; Dahllöf 1957; Henrysson 1960; Karvonen 1963 and 1965). Although school marks have statistically been criticized, studies in many countries show that they are useful in school achievement research, especially if the teachers have been guided and the reports have been adjusted (Bloom and Peters 1961, Vernon 1957,Lavin 1965, Marklund, Henrysson and Paulin 1968).

In the present study the interrelations between school marks and the structure of school marks were studied through correlation methods and factor analysis. This was done in such a way that three groups were formed: boys, girls and a combined group of boys and girls. All the operations were carried out by using these three groups. The purpose of forming the combined group is to control the invariances eventually caused by using a small number of subjects, to confirm the interpretation through results of various groups and to obtain methodological information about the indexes between different groups. The intercorrelations of school subjects are presented in Tables 1, 2 and 3. The means and standard deviations are given in the same tables.

Table 1. Intercorrelations, means and standard deviations of school marks. Girls, N = 87

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	X̄	s
Carefulness	1.															8,53	0,88
Religion	2.	574														7,62	0,75
Reading (and literature)	3.	528	540													7,64	0,77
Composition	4.	413	455	627												7,34	0,63
Civics	5.	674	713	578	506											7,39	0,75
Mathematics	6.	638	504	568	449	676										6,64	1,02
Book-keeping	7.	636	588	467	423	689	701									6,82	0,89
Home economics	8.	406	263	148	177	385	329	286								7,34	0,53
Physical education	9.	268	203	303	117	093	092	161	097							7,78	0,74
Handcrafts	10.	545	388	400	336	409	391	394	287	226						7,63	0,77
Vocational guidance	11.	574	630	587	521	760	596	670	297	046	445					7,23	1,01
Music	12.	-009	-113	-064	088	-144	-108	-126	-001	137	-047	-131				7,65	1,01
Penmanship	13.	262	244	224	273	101	042	108	047	270	168	042	130			7,50	0,82
Drawing	14.	175	188	022	126	124	054	158	014	436	248	028	081	213		7,41	0,77
Mean	15.	783	723	667	589	851	735	806	445	291	510	783	-011	192	172	7,42	0,57

Table 2. Intercorrelations, means and standard deviations of school marks. Boys, N = 70

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	$\bar{X}$	s
Carefulness	1																8.53	0.87
Religion	2	538															7.45	0.83
Reading (and literature)	3	313	453														7.51	0.82
Composition	4	450	384	521													6.88	0.83
Civics	5	658	599	453	503												6.96	0.97
Mathematics	6	625	413	279	485	707											6.68	1.11
Book-keeping	7	625	437	181	486	446	514										7.28	0.97
Home economics	8	432	268	184	151	327	257	242									7.31	0.69
Phys. educ.	9	181	294	300	368	192	181	340	167								7.92	0.93
Woodwork	10	352	009	128	258	285	286	349	305	185							7.42	0.91
Metalwork	11	358	286	295	193	320	312	235	229	152	464						7.43	0.68
Vocat.guid.	12	670	565	327	399	743	637	575	413	250	369	299					7.39	0.86
Music	13	036	237	231	247	122	017	060	031	367	-141	-079	145				6.91	1.35
Penmanship	14	196	237	220	454	169	185	186	039	409	182	144	244	316			7.09	0.89
Drawing	15	315	228	327	333	359	312	184	398	270	226	312	353	269	359		7.43	1.06
Mean	16	764	594	463	531	737	717	706	523	409	495	455	799	044	234	453	7.37	0.59

Table 3. Intercorrelations, means and standard deviations of school marks. Girls + Boys, N = 157

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	$\bar{X}$	s
Carefulness	1															8.53	0.87
Religion	2	553														7.55	0.79
Reading (and literature)	3	427	502													7.58	0.79
Composition	4	408	425	562												7.14	0.78
Civics	5	640	653	513	539											7.20	0.88
Mathematics	6	631	454	424	440	664										6.66	1.06
Book-keeping	7	613	471	299	355	467	597									7.02	0.95
Home economics	8	415	266	168	162	347	289	248								7.33	0.60
Phys.educ.	9	223	239	292	228	123	140	265	134							7.84	0.83
Handcrafts	10	486	294	333	324	396	365	332	297	194						7.53	0.74
Vocat. guid.	11	609	582	464	403	689	608	625	340	143	407					7.30	0.95
Music	12	014	104	138	253	084	-045	-095	025	229	-037	-026				7.32	1.22
Penmanship	13	224	258	233	411	187	104	082	048	311	207	103	283			7.32	0.87
Drawing	14	245	203	184	237	251	194	169	239	339	267	180	180	279		7.42	0.91
Mean	15	774	661	572	539	772	725	726	483	345	527	779	029	238	317	7.40	0.58

The means and standard deviations will not be discussed in the present report in detail; they will be discussed in another article. Only a few findings relevant to the approach adopted in this study will be mentioned at this point.

The means for various school subjects show that the teachers had quite closely followed the suggestions given in a circular by the National School Board that the mean of the marks fall within the interval from 7 to 8 and that for carefulness be about 8.5. A distinct exception was provided by mathematics, in which the mean is the lowest. Girls were superior to boys in theoretical subjects, though all differences were not statistically significant. This finding is similar to those reported by Cavonius 1961 and Lavin 1965.

Factor analysis was employed in the present study to investigate the structure of school achievement and to construct new variables for purposes of further analysis by means of factor scores.

The number of school achievement factors obtained in previous studies (Henrysson 1960; Heinonen 1964) has been small. This may be explained in terms of the fundamental psychic functions making for variance in school achievement variables and/or in terms of the principles observed in pupil evaluation. When a battery which is liable to elicit general factors is factor-analyzed, the choice of methods is of significance. This was why two factoring methods, the principal component analysis and the principal factor method, were used in the present study.

The two methods differ, in that the total variance to be explained is maximized in the principal component analysis, while the residuals are minimized in the principal factor method. The first is a variance-oriented method, the second being covariance-oriented. Principal component analysis starts from a correlation matrix where the diagonal elements are equal to unity, whereas in factor analysis the diagonal entries are estimates of the communalities. In the present study only the highest correlations of variables were used as the estimates of their communalities.

The principal components are presented in Tables 4, 5 and 6. Previous studies were drawn on in specifying the number of components. Only five components were computed for each group. The principal component analysis is orientating and therefore the number of components can be small. In the complete analysis as many components as variables could be computed. The principal component matrixes will be interpreted below through naming only the largest components and listing the variables which remained outside the components.

Table 4. Principal component matrix, school marks.

Girls, N = 87

		I	II	III	IV	V
Carefulness	1.	-.82	.08	-.12	.15	-.10
Religion	2.	-.78	.01	.02	-.16	-.06
Reading (and literature)	3.	-.74	.04	.36	-.19	.02
Composition	4.	-.66	.10	.50	-.03	.04
Civics	5.	-.87	-.20	-.04	-.01	.04
Mathematics	6.	-.79	-.22	-.03	.04	.13
Book-keeping	7.	-.81	-.13	-.12	-.05	.15
Home economics	8.	-.44	-.08	-.37	.63	-.34
Physical education	9.	-.29	.71	-.21	-.10	.13
Handcrafts	10.	-.60	.18	-.24	.04	-.13
Vocational guidance	11.	-.82	-.26	.07	-.05	.10
Music	12.	.08	.46	.39	.65	.39
Penmanship	13.	-.25	.58	.32	-.07	-.61
Drawing	14.	-.21	.66	-.41	-.22	.25
Mean	15.	-.95	-.02	-.01	.08	.07
Eigenvalues		6,622	1,717	1,066	0,988	0,802
Product of eigenvalues		6,622	11,370	12,120	11,975	9,604
Eigenvalues as a percentage of the number of variables		44,13	11,47	7,30	6,60	5,33

Component I is a general component of theoretical subjects, with a loading in handcrafts also.
Component II is a general component of skill subjects.
A major part of the variance of music, home economics and penmanship is unaccounted for by these components.

Table 5. Principal component matrix, school marks.

Boys, N = 70

		I	II	III	IV	V
Carefulness	1.	-.80	.25	.15	-.02	.10
Religion	2.	-.68	-.13	.41	.13	-.08
Reading (and literature)	3.	-.55	-.35	.07	.23	-.54
Composition	4.	-.67	-.32	.03	-.29	-.19
Civics	5.	-.81	.12	.29	.10	-.13
Mathematics	6.	-.75	.22	.20	-.13	-.03
Book-keeping	7.	-.70	.15	.09	-.40	.24
Home economics	8.	-.50	.21	-.23	.55	.39
Physical education	9.	-.45	-.51	-.24	-.21	.25
Woodwork	10.	-.47	.34	-.62	-.21	-.03
Metalwork	11.	-.50	.23	-.44	.07	-.46
Vocational guidance	12.	-.82	.16	.17	.04	.17
Music	13.	-.21	-.75	.11	.18	.18
Penmanship	14.	-.40	-.55	-.30	-.28	.05
Drawing	15.	-.54	-.24	-.37	.43	.05
Mean	16.	-.94	.17	-.02	-.01	.07
Eigenvalues		6,537	1,823	1,278	1,038	0,912
Product of eigenvalues		6,537	11,982	15,313	15,895	14,496
Eigenvalues as a percentage of the number of variables		40,88	11,44	8,00	6,50	5,69

The components are interpreted as follows:
Component I is a general component of school **subjects**.
Component II is a skill subject component.
Component III is a handcrafts component.
The remaining components might be named as follows:
Component IV is a home economics component.
Component V is a component of oral presentation.

Table 6. Principal component matrix, school marks.
Girls + Boys, N = 157

		I	II	III	IV	V
Carefulness	1.	-.82	.15	-.10	.01	.01
Religion	2.	-.74	-.02	.20	.03	-.17
Reading (and literature)	3.	-.66	-.19	.33	-.05	.08
Composition	4.	-.65	-.33	.36	.05	.20
Civics	5.	-.83	.11	.19	.21	-.00
Mathematics	6.	-.76	.26	.08	-.04	-.03
Book-keeping	7.	-.71	.27	-.07	-.35	-.22
Home economics	8.	-.47	.12	-.51	.54	-.11
Physical education	9.	-.37	-.51	-.32	-.48	-.33
Handcrafts	10.	-.58	.01	-.30	-.02	.56
Vocational guidance	11.	-.80	.27	.08	.01	-.09
Music	12.	-.10	-.69	.18	.39	-.36
Penmanship	13.	-.34	-.65	.06	-.10	.33
Drawing	14.	-.38	-.42	-.52	.04	.04
Mean	15.	-.95	.11	-.06	-.03	-.07
Eigenvalues		6,332	1,751	1,104	0,858	0,805
Product of eigenvalues		6,332	11,087	12,240	10,502	8,454
Eigenvalues as a percentage of the number of variables		42,20	22,67	7,33	5,67	5,33

Two of the components are named as follows:
Component I is a general component of school subjects.
Component II is a component of skill subjects.
A major part of the variance of home economics, handcrafts, physical education and drawing remains outside these components.

The results of principal component analysis can be summarized as follows: In each group, the first principal component accounts for a large proportion of the variance, forming a general school-subject or theoretical-subject component. The eigenvalue percentages of the number of the variables are 41-44. Either a single skill-subject component or several such components emerge from the analysis. The remaining components are smaller and provide information about the specificity of certain school subjects. The results find support in previous studies (Heinonen 1964, Henrysson 1960). The information contained in the principal component matrix is employed to specify the number of factors in principal factor analysis, and it is helpful in the interpretation of rotated factors.

In the factor analysis of school subjects, use could be made of Heinonen's (1964) studies and the results yielded by the principal component analysis. These suggest the hypothesis that the following factors would emerge: a factor of theoretical subjects, a factor of skill subjects and a factor reflecting the specificity of music. The results of the principal component analysis also made probable the emergence of a separate handcrafts factor for boys. Moreover, they appeared to justify the expectation that certain factors reflecting the specificity of some school subjects would be obtained, although they did not permit formulating any specific, well-founded hypotheses.

The correlation matrix was factored through the principal factor method (Harman 1962). The highest correlations were used as the estimates of communalities. The mean of the subject marks was not excluded from the factor analysis, even though it is not advisable to include variables depending on one another functionally in batteries subjected to factorial analysis. The mean was expected to behave in either of two different ways: to have a loading on the factor of theoretical subjects or to form a factor together with certain specific subjects. If the second alternative materialized, the inclusion of the mean in the battery would partly remedy the defect that each school subject was represented only by a single variable.

Previous studies and the results of principal component analysis were used to estimate the number of requisite factors. According to previous studies 4-6 factors would be sufficient to explain the structure (Heinonen 1964, Henrysson 1960, Niskanen unpubl.). In the principal component analysis it was found that five factors were with a high probability sufficient to explain the structure. Six factors were extracted, since it is usually advisable to compute more factors than the hypotheses suggest.

The rotation took place through Kaiser's varimax method (Harman 1962). The following criteria were available for selecting the number of factors to be rotated: the absolute values of the loadings, the eigenvalues, the product of eigenvalues, the eigenvalues as a percentage of the number of factors and the communalities after the extraction of each factor. In addition, use could be made of the results of the principal component analysis. Both a four-factor rotation and a five-factor rotation were performed for each group. The factor matrices and rotated matrices are presented in Tables 7 to 12.

The five-factor rotation provides a more clear-cut picture of the structure of school achievement in the girl group than does the four-factor rotation. The factors are interpreted as follows.

Table 7. Unrotated factor matrix, school marks.

Girls, N = 87

		I	II	III	IV	V	VI
Carefulness	1.	-.81	.11	.20	.18	.04	-.02
Religion	2.	-.76	.03	-.06	-.21	-.26	.05
Reading (and literature)	3.	-.72	.06	-.39	.06	.11	-.11
Composition	4.	-.63	.09	-.44	.13	-.01	.05
Civics	5.	-.87	-.20	.04	-.10	-.16	.08
Mathematics	6.	-.77	-.21	.06	.04	.29	.03
Book-keeping	7.	-.80	-.13	.16	-.21	.21	.11
Home economics	8.	-.41	-.05	.33	.34	-.15	.10
Physical education	9.	-.26	.60	.06	-.06	.10	.02
Handcrafts	10.	-.57	.19	.15	.12	-.03	-.38
Vocational guidance	11.	-.81	-.26	-.08	-.08	-.11	-.11
Music	12.	.07	.27	-.07	.20	.02	.18
Penmanship	13.	-.23	.42	-.15	.07	-.09	.09
Drawing	14.	-.19	.55	.18	-.25	-.01	-.02
Mean	15.	-.95	-.00	.05	.03	.01	.11
Eigenvalues		6,362	1,148	0,613	0,401	0,292	0,258
Product of eigenvalues		6,362	7,304	4,477	1,795	0,525	0,135
Eigenvalues as a percentage of the number of variables		42,41	7,653	4,09	2,67	1,95	1,72

Table 8. Rotated factor matrix, school marks.

Girls, N = 87

		I	II	III	IV	V	h^2
Carefulness	1.	-.63	.27	-.48	-.07	.20	.74
Religion	2.	-.31	.28	-.62	-.35	-.15	.70
Reading (and literature)	3.	-.14	.13	-.79	.04	.15	.68
Composition	4.	-.13	.09	-.75	.14	.01	.61
Civics	5.	-.48	.09	-.65	-.42	.01	.83
Mathematics	6.	-.41	.01	-.55	-.24	.44	.73
Book-keeping	7.	-.37	.20	-.52	-.44	.37	.77
Home economics	8.	-.64	-.01	-.10	.00	-.00	.42
Physical education	9.	-.09	.62	-.12	.17	.09	.44
Handcrafts	10.	-.45	.29	-.33	-.01	.08	.40
Vocational guidance	11.	-.37	-.02	-.69	-.37	.03	.75
Music	12.	.00	.13	.02	.33	-.02	.12
Penmanship	13.	-.05	.36	-.24	.24	-.11	.26
Drawing	14.	-.05	.66	-.00	-.03	-.00	.44
Mean	15.	-.54	.23	-.69	-.23	.17	.91

Factor I	
home economics	.64
carefulness	.63
mean	.54
civics	.48
handcrafts	.45
arithmetic	.41
vocational guidance	.37
book-keeping	.37
religion	.31

This factor explains the variance of home economics almost entirely. Also, it accounts for a larger proportion of the variance of handcrafts and carefulness than do the other factors, whereas the opposite is true for the variances of the other school subjects listed above. Moreover, the communalities of home economics and handcrafts are smaller than those of the other school subjects loaded on this factor. A factor of careful action might be an appropriate name. The writer prefers, however, to term it a home economics factor, in accordance with the top test and in order to point out the similarity that this factor has to the corresponding factors for the boy group and the combined group.

Factor II

drawing	.66
physical education	.62
penmanship	.36
(handcrafts	.29)

Taking into account the results of previous school subject studies, this factor could have been interpreted as a skill subject factor. Not all the skill subjects have appreciable loadings on this factor, however, and thus a partial factor of skill subjects is a more appropriate name.

Factor III

reading and literature	.79
composition	.75
mean	.69
vocational guidance	.68
civics	.65
religion	.61
mathematics	.55
book-keeping	.52
carefulness	.48
(handcrafts	.33)

Factor III is a theoretical-subject factor.

Factor IV

book-keeping	.-44
civics	.-42
vocational guidance	.-37
religion	.-35
(music	.+33)

This factor is difficult to interpret. Moreover, the results of the principal component analysis are not helpful here; the first principal component, though it contributes most to the variances of the first four variables listed above, does not explain the variance of music. Factor IV explains the variance of music almost entirely; it might therefore be appropriate to name it a music factor. Nevertheless, the writer names it a specific factor of theoretical citizenship-school subjects, since the theoretical subjects peculiar to citizenship schools are loaded on it.

Factor V

mathematics	.43
book-keeping	.37

This is named a mathematical factor.

The school achievement structure of the boy group is also interpreted on the basis of the five-factor rotation.

Table 9. Unrotated factor matrix, school marks.

Boys, N = 70

		I	II	III	IV	V	VI
Carefulness	1.	-.80	.24	.11	-.03	-.08	.03
Religion	2.	-.65	-.14	.33	.12	-.02	.26
Reading (and literature)	3.	-.53	-.33	.05	.21	.29	.17
Composition	4.	-.64	-.30	.01	-.20	.18	-.07
Civics	5.	-.80	.10	.26	.14	.15	-.12
Mathematics	6.	-.74	.20	.17	-.10	.14	-.27
Book-keeping	7.	-.69	.14	.04	-.42	-.18	.16
Home economics	8.	-.47	.17	-.21	.36	-.31	.02
Physical education	9.	-.42	-.42	-.17	-.15	-.15	.11
Woodwork	10.	-.45	.26	-.50	-.12	.09	-.01
Metalwork	11.	-.47	.16	-.34	.09	.26	.20
Vocational guidance	12.	-.82	.15	.14	.04	-.15	-.11
Music	13.	-.19	-.59	.09	.07	-.15	-.03
Penmanship	14.	-.38	-.47	-.21	-.17	-.01	-.15
Drawing	15.	-.50	-.22	-.27	.27	-.05	-.18
Mean	16.	-.93	.14	-.06	-.01	-.06	.05
Eigenvalues		6,198	1,307	0,811	0,587	0,446	0,338
Product of eigenvalues		6,198	8,101	6,570	3,857	1,720	0,581
Eigenvalues as a percentage of the number of variables		38,74	8,18	5,07	3,63	2,79	2,11

Table 10. Rotated factor matrix, school marks.

Boys, N = 70

		I	II	III	IV	V	h^2
Carefulness	1.	-.77	-.09	-.23	.23	.05	.71
Religion	2.	-.61	-.25	.12	.16	.29	.57
Reading (and literature)	3.	-.28	-.36	-.09	.08	.55	.52
Composition	4.	-.45	-.51	-.20	-.10	.23	.57
Civics	5.	-.76	-.09	-.12	.16	.38	.77
Mathematics	6.	-.74	-.07	-.24	.02	.17	.64
Book-keeping	7.	-.71	-.27	-.24	-.00	-.26	.70
Home economics	8.	-.28	-.04	-.19	.64	.01	.53
Physical education	9.	-.17	-.62	-.09	.11	-.01	.43
Woodwork	10.	-.22	-.08	-.67	.16	-.07	.54
Metalwork	11.	-.22	-.05	-.55	.16	.23	.43
Vocational guidance	12.	-.77	-.16	-.14	.31	.08	.74
Music	13.	-.02	-.55	.28	.11	.16	.41
Penmanship	14.	-.10	-.63	-.15	.00	.07	.44
Drawing	15.	-.15	-.37	-.23	.42	.25	.45
Mean	16.	-.77	-.25	-.38	.31	.11	.90

Factor I

vocational guidance	.77
carefulness	.77
mean	.77
civics	.76
mathematics	.74
book-keeping	.71
religion	.61
composition	.45

Factor I is named a general factor of theoretical subjects.

Factor II

penmanship	.63
physical education	.62
music	.55
composition	.51
drawing	.37
(reading and literature)	.36

This factor is spanned mainly by skill subjects.Woodwork and metalwork do not,however,obtain loadings on it.The high loading of composition has a rather natural explanation:handwriting is the important component in evaluating boys' achievements in this shool subject.

Factor III

woodwork	.67
metalwork	.55
(mean	.38)

This is a handcrafts factor

Factor IV

home economics	.64
drawing	.42
vocational guidance	.31
mean	.31

This factor can be identified with the fourth component yielded by the principal component anlysis.It is named a home economics factor.

Factor V

reading and literature	.55
civics	.38
(religion	.29)

This factor can be identified with the fifth component obtained through the principal component method.It is named a reading factor.

In the case of the combined group the interpretation is also based on the five-factor rotation.

Table 11. Unrotated factor matrix, school marks.
Girls + Boys, N = 157

		I	II	III	IV	V	VI
Carefulness	1.	-.81	.13	.15	.01	-.04	-.07
Religion	2.	-.72	-.05	-.18	.02	.25	.16
Reading (and literature)	3.	-.63	-.22	-.26	.03	-.10	.18
Composition	4.	-.62	-.34	-.24	.00	-.16	-.09
Civics	5.	-.82	.07	-.21	.23	.06	-.09
Mathematics	6.	-.75	.24	-.08	-.06	-.12	-.26
Book-keeping	7.	-.70	.27	.10	-.41	.05	-.03
Home economics	8.	-.44	.09	.36	.32	.16	-.03
Physical education	9.	-.34	-.39	.23	-.23	.09	.08
Handcrafts	10.	-.55	-.02	.26	.12	-.34	.17
Vocational guidance	11.	-.79	.25	-.09	.00	.09	.12
Music	12.	-.09	-.50	-.06	.04	.15	-.12
Penmanship	13.	-.31	-.54	.03	-.06	-.06	-.05
Drawing	14.	-.35	-.32	.30	.03	.04	-.06
Mean	15.	-.94	.08	.08	-.03	.03	.02
Eigenvalues		6,014	1,189	0,603	0,402	0,307	0,224
Product of eigenvalues		6,014	7,151	4,312	1,733	0,532	0,119
Eigenvalues as a percentage of the number of variables		40,07	7,93	4,00	2,67	2,07	1,47

Table 12. Rotated factor matrix, school marks.

Girls + Boys, N = 157

		I	II	III	IV	V	h^2
Carefulness	1.	-.63	-.11	.35	-.30	-.28	.69
Religion	2.	-.70	-.26	.18	-.12	.10	.61
Reading (and literature)	3.	-.60	-.34	-.04	.03	-.18	.52
Composition	4.	-.56	-.45	-.08	.03	-.23	.58
Civics	5.	-.83	-.12	.25	.04	-.11	.78
Mathematics	6.	-.70	.03	.12	-.26	-.27	.64
Book-keeping	7.	-.56	.00	.11	-.64	-.12	.75
Home economics	8.	-.25	-.05	.62	-.05	-.10	.46
Physical education	9.	-.08	-.52	.12	-.30	-.05	.38
Handcrafts	10.	-.32	-.14	.28	-.11	-.54	.50
Vocational guidance	11.	-.77	.02	.23	-.24	-.08	.71
Music	12.	-.02	-.50	.00	.14	.12	.28
Penmanship	13.	-.13	-.60	-.01	-.01	-.15	.39
Drawing	14.	-.09	-.43	.31	-.13	-.15	.32
Mean	15.	-.76	-.19	.34	-.33	-.22	.89

Factor I

civics	.83
vocational guidance	.77
mean	.76
religion	.70
mathematics	.70
carefulness	.63
reading and literature	.60
composition	.56
book-keeping	.56

Factor I is a general factor of theoretical subjects.

Factor II

penmanship	.60
physical education	.52
music	.50
composition	.45
drawing	.43
(reading and literature	.34)

This is a skill subject factor. Handcrafts is the only skill subject not loaded on it.

Factor III

home economics	.62
carefulness	.35
mean	.34
drawing	.31

This is named a home-economics factor.

Factor IV

book-keeping	.64
mean	.33

This is named a book-keeping factor.

Factor V

handcrafts	.54
(carefulness	.28)

This is a handcrafts factor.

The results obtained for various groups will be compared in a later context (Chapter 6.) by employing the transformation analysis technique. At this point, only the following observations, relevant to the line of approach pursued in this study, are called for.

An intra-group comparison of the results of the principal components method and factor analysis revealed that, interpretationally, the two procedures yielded more similar results for the boy group and the combined group than for the girl group. Inter-group comparisons showed, on the other hand, that the hypothesized factors of theoretical subjects and skill subjects emerged for all three groups, and that the hypothesized handcrafts factor for boys was also obtained. The battery employed co-determines, of course, the resulting factors. Apparent differences between factorial results may be due to actual structural differences and/or to a bias caused by separate, mutually independent rotations. Where a rotation bias is present, even structurally similar may appear different and lead to divergent interpretations. Transformation analysis can be used to exclude this possibility.

In order to obtain more differentiated knowledge of the structure of school achievement for certain objectives, it would be necessary first to analyze various school subjects by means of standardized school achievement tests and ratings done by teachers. Then, the primary factors thus obtained for various school subjects should be used as variables in investigating the structure of school achievement, considered as a whole.

3.2. The Intelligence Variables

These were chosen so as to represent various factors of mental ability. Heinonen's (1963) six intelligence tests and eight of the tests of the Vocational Guidance Office (AVO-testistö I) were employed. The tests are described in the manuals referred to. Previous studies have shown that the reliability of these tests is high, and therefore the reliabilities of no more than two tests were investigated in the present study. It should be pointed out, moreover, that the communality of a test can be taken to indicate the lower limit of its reliability. The reliabilities are set out in the correlation matrix tables (Tables 13-15). The ratings given by teachers on the subjects' general intelligence level were used as the criterion against which the intelligence tests were validated. The validity coefficients thus obtained are also presented in connection with the correlation matrices.

Norms were available for the AVO tests and for Heinonen's tests, except Additions and Number Cancelling. Thus it was possible to find out how far the present group of test subjects was representative with respect to intelligence. The norms for the AVO tests have been computed from the results of some 3,000 to 6,000 individuals, and they can thus be considered comparatively dependable. Those for Heinonen's tests, again, have been determined from the results of 150 to 200 subjects. The means of the standard scores of the present girl and boy groups on all the tests employed were close to zero, indicating that the group of subjects was representative in this respect.

Factor analysis was employed to investigate the mental ability structure of the subject groups. Another objective was to provide a foundation for the construction of new variables, on the basis of factor scores, so as to make it possible to describe the interrelations among various components of intelligence at the factor level. The procedure applied was similar, in principle, to that described in the preceding section. Factoring, rotation and interpretation were guided by the results yielded by AVO's and Heinonen's analyses. Heinonen's tests were used in pilot studies with the subjects of the present study (Niskanen 1964). According to these results 5-6 factors could be obtained.

Table 13. Intercorrelations of intelligence tests.

Girls, N = 8

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	reliability A V O
opposites	1.															
synonyms	2.	659														
word analogies	3.	458	399													
mathemathical problems	4.	430	475	307												
additions	5.	600	421	227	387											
number cancelling	6.	319	140	087	-012	328										
V_1/K	7.	453	503	414	395	223	-039									71
V_3/K	8.	459	484	388	322	146	-070	561								80
S_2/K	9.	146	295	285	292	178	-037	287	302							96
S_6/K	10.	129	174	319	250	106	130	308	178	452						81
R_2/K	11.	181	277	305	350	167	136	330	192	352	269					95
R_3/OK	12.	186	211	320	348	085	-119	320	403	429	262	370				88
N_1/K	13.	555	406	293	356	700	362	265	071	101	207	229	046			71
N_2/K	14.	335	252	373	155	413	340	239	077	113	300	191	-078	584		71
general intelligence level as rated by teachers	15.	291	322	134	104	067	060	227	314	297	025	128	197	045	120	

Table 14. Unrotated factor matrix, intelligence tests.

Girls, N = 87

		I	II	III	IV	V	VI	VII	VIII
opposites	1.	-.75	.21	.33	.03	.04	-.05	.08	.10
synonyms	2.	-.73	-.03	.30	.02	.05	.02	-.22	.06
word analogies	3.	-.60	-.11	-.09	.19	-.13	-.10	.14	-.03
mathemathical problems	4.	-.60	-.11	.01	-.33	-.10	-.02	-.10	-.01
additions	5.	-.61	.48	.06	-.28	.09	.13	.11	-.01
number cancelling	6.	-.24	.46	-.11	.15	.21	-.18	.00	.16
V_1/K	7.	-.64	-.27	.09	.10	-.25	.02	-.07	-.02
V_3/K	8.	-.56	-.40	.28	.14	-.07	.04	.11	.04
S_2/K	9.	-.46	-.37	-.30	-.04	.24	.17	-.02	-.00
S6/K	10.	-.42	-.15	-.49	.09	-.07	.11	-.02	.19
R_2/K	11.	-.46	-.17	-.28	-.11	.06	-.25	-.10	-.08
R_3/OK	12.	-.41	-.48	-.12	-.19	.08	-.09	.16	-.04
N_1/K	13.	-.63	.55	-.09	-.12	-.06	.03	.01	-.09
N_2/K	14.	-.49	.44	-.27	.31	-.10	.05	-.02	-.14
general intelligence level as rated by teachers	15.	-.33	-.19	.17	.23	.34	.05	-.03	-.13
eigenvalues		4,503	1,698	0,850	0,504	0,356	0,184	0,151	0,132
product of eigenvalues		4,503	7,646	6,499	3,275	1,166	0,215	0,032	0,004
eigenvalues as a percentage of the number of variables		30	11,3	5,7	3,3	2,4	1,2	1,0	0,9

Table 15. Rotated factor matrix, intelligence tests.

Girls, N = 87

		I	II	III	IV	V	h^2
opposites	1.	-.50	.26	-.02	-.57	.29	.73
synonyms	2.	-.54	.11	-.16	-.45	.31	.63
word analogies	3.	-.48	.27	-.33	-.10	.08	.44
mathemathical problems	4.	-.34	-.07	-.38	-.47	-.05	.49
additions	5.	-.09	.32	-.09	-.76	.05	.70
number cancelling	6.	.12	.50	.03	-.24	.16	.35
V_1/K	7.	-.67	.07	-.30	-.15	.05	.57
V_3/K	8.	-.66	-.11	-.23	-.09	.28	.58
S_2/K	9.	-.13	.01	-.65	-.05	.24	.50
S_6/K	10.	-.16	.30	-.57	.05	-.08	.45
R_2/K	11.	-.14	.09	-.52	-.16	.04	.33
R_3/OK	12.	-.25	-.23	-.56	-.09	.13	.46
N_1/K	13.	-.14	.53	-.11	-.64	-.09	.73
N_2/K	14.	-.19	.72	-.12	-.18	-.04	.60
general intelligence level as rated by teachers	15.	-.22	.04	-.14	-.02	.52	.34

Both a five-factor and a six-factor rotation were performed for the girl group, but the sixth factor did not prove interpretable. The five dimensions yielded by the five-factor rotation are interpreted as follows:

Factor I - verbal factor
Factor II - numerical factor
Factor III - visualization and reasoning factor
Factor IV - comprehension of verbal relationships and numerical factor
Factor V - intelligence as rated by teachers

Table 16. Intercorrelations of intelligence tests.

Boys, N = 70

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	reliabili A V O
opposites	1.															
synonyms	2.	591														
word analogies	3.	295	459													
mathemathical problems	4.	289	217	174												
additions	5.	231	380	362	473											
number cancelling	6.	095	197	203	238	344										
V_1/K	7.	353	540	367	352	157	115									80
V_3/K	8.	289	584	295	352	175	-034	637								86
S_2/K	9.	138	-082	009	266	050	056	054	-019							87
S_6/K	10.	130	390	385	306	298	174	369	173	340						81
R_2/K	11.	242	265	330	487	502	300	273	176	395	423					96
R_3/OK	12.	189	260	270	138	211	166	259	236	047	192	521				89
N_1/K	13.	099	206	309	457	686	215	109	136	149	323	398	050			81
N_2/K	14.	140	241	230	385	555	181	160	269	052	197	413	070	628		81
general intelligence level as rated by teachers	15.	089	192	235	380	259	194	324	267	103	248	488	290	187	327	

Table 17. Unrotated factor matrix, intelligence tests.

Boys, N = 70

		I	II	III	IV	V	VI	VII	VIII
opposites	1.	-.46	.35	.08	-.19	-.34	.36	.01	.10
synonyms	2.	-.63	.45	.22	-.19	-.08	-.02	-.01	.03
word analogies	3.	-.55	.15	.06	-.25	.02	-.25	.05	.10
mathemathical problems	4.	-.62	-.16	-.06	.26	-.10	.16	-.14	-.11
additions	5.	-.69	-.37	.25	-.18	.03	.05	-.02	-.11
number cancelling	6.	-.35	-.18	-.07	-.26	.07	.01	-.35	-.05
V_1/K	7.	-.58	.50	-.03	.21	.01	-.13	-.11	-.06
V_3/K	8.	-.53	.49	.18	.32	.11	.01	.08	-.10
S_2/K	9.	-.22	-.20	-.44	.16	-.39	.00	.07	.00
S_6/K	10.	-.53	-.01	-.21	-.02	-.21	-.35	.01	.02
R_2/K	11.	-.69	-.21	-.37	-.05	.06	.08	.08	.01
R3/OK	12.	-.42	.15	-.36	-.25	.32	.10	.21	-.12
N_1/K	13.	-.60	-.50	.29	.04	-.08	-.10	.10	-.06
N_2/K	14.	-.58	-.36	.30	.17	.12	.07	.10	.16
general intelligence level as rated by teachers	15.	-.51	-.04	-.25	.19	.31	.04	-.13	.19
eigenvalues		4,477	1,517	0,901	0,609	0,573	0,394	0,250	0,141
product of eigenvalues		4,477	6,792	6,113	3,723	2,133	0,840	0,210	0,029
eigenvalues as a percentage of the number of variables		31,8	10,0	6,0	4,1	3,8	2,6	1,7	0,9

Table 18. Rotated factor matrix, intelligence tests.

Boys, N = 70

		I	II	III	IV	V	VI	h^2
opposites	1.	-.08	.24	-.12	-.73	.09	-.09	.62
synonyms	2.	-.17	.48	.10	-.50	.13	-.40	.70
word analogics	3.	-.21	.24	.02	-.17	.22	-.52	.46
mathematihical problems	4.	-.48	.30	-.38	-.14	.19	.05	.52
additions	5.	-.75	.01	-.01	-.20	.23	-.24	.71
number cancelling	6.	-.26	-.10	-.04	-.10	.31	-.21	.23
V_1/K	7.	-.03	.72	-.12	-.17	.17	-.25	.65
V_3/K	8.	-.13	.78	.05	-.18	.08	-.06	.68
S_2/K	9.	-.05	-.04	-.67	-.04	.07	-.03	.46
S_6/K	10.	-.18	.21	-.40	-.02	.14	-.49	.50
R_2/K	11.	-.38	.11	-.40	-.10	.57	-.15	.67
R_3/OK	12.	.02	.14	-.01	-.12	.67	-.15	.51
N_1/K	13.	-.80	.03	-.15	-.00	-.01	-.22	.72
N_2/K	14.	-.75	.20	-.02	-.00	.10	.00	.61
general intelligence level as rated by teachers	15.	-.25	.33	-.17	.12	.49	.01	.45

The interpretation for the boy group is based on the six-factor rotations. The factors for boys are named as follows:

Factor I - numerical factor
Factor II - verbal fluency
Factor III - visualization and numerical reasoning
Factor IV - comprehension of verbal relationships
Factor V - non-verbal reasoning
Factor VI - verbal and non-verbal reasoning

Table 19. Intercorrelations of intelligence tests.

Girls + Boys, N = 157

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	reliability	
																Heinonen,	Niskanen
opposites	1.															83	
synonyms	2.	630														89	
word analogies	3.	391	431													89	82
mathemathical problems	4.	308	308	210												80	67
additions	5.	356	359	241	455											87	
number cancelling	6.	236	181	150	051	280										81	
V_1/K	7.	416	530	408	326	149	051										
V_3/K	8.	382	539	359	303	131	-034	602									
S_2/K	9.	133	078	142	278	113	-000	154	125								
S_6/K	10.	097	250	311	302	226	112	298	153	389							
R_2/K	11.	192	256	297	420	331	180	285	173	371	346						
R_3/OK	12	181	230	293	248	145	-008	285	323	226	230	437					
N_1/K	13.	332	308	289	393	679	299	192	091	120	255	295	048				
N_2/K	14.	244	253	320	240	450	283	212	172	076	236	281	-012	592			
general intelligence level as rated by teachers	15.	205	271	219	200	125	133	287	302	186	102	274	235	094	222		

Table 20. Unrotated factor matrix, intelligence tests.

Girls + Boys. N = 157

		I	II	III	IV	V	VI	VII
opposites	1.	-.62	-.08	.37	-.17	.23	-.15	-.11
synonyms	2.	-.69	-.20	.33	-.07	.07	-.10	.01
word analogies	3.	-.58	-.12	.06	.20	.07	-.08	.21
mathemathical problems	4.	-.58	.05	-.21	-.27	-.16	.04	-.10
additions	5.	-.61	.49	.02	-.26	-.02	.09	.07
number cancelling	6.	-.28	.30	.11	.16	.30	-.01	-.04
V_1/K	7.	-.62	-.39	.12	.09	-.18	-.04	.00
V_3/K	8.	-.56	-.48	.20	-.00	-.21	.12	-.02
S_2/K	9.	-.33	-.09	-.48	-.00	.03	-.19	-.21
S_6/K	10.	-.45	.00	-.35	.14	-.08	-.28	.06
R_2/K	11.	-.56	.01	-.41	.02	.14	.11	.02
R_3/OK	12.	-.41	-.32	-.31	-.09	.17	.18	.21
N_1/K	13.	-.60	.57	.06	-.03	-.12	-.01	.05
N_2/K	14.	-.53	.42	.09	.33	-.14	.10	-.05
general intelligence level as rated by teachers	15.	-.39	-.16	-.05	.16	.11	.25	-.21
eigenvalues		4,270	1,412	0,981	0,416	0,352	0,295	0,212
product of eigenvalues		4,270	6,024	5,910	2,459	0,863	0,255	0,054
eigenvalues as a percentage of the number of variables		28,5	9,4	6,5	2,8	2,3	2,0	1,4

Table 21. Rotated factor matrix, intelligence tests.

Girls + Boys, N = 157

		I	II	III	IV	V	VI	h^2
opposites	1.	-.64	-.22	-.03	-.27	.32	.05	.63
synonyms	2.	-.73	-.07	-.08	-.23	.20	.10	.65
word analogies	3.	-.47	.15	-.25	-.11	.24	.16	.40
mathemathical problems	4.	-.25	-.06	-.31	-.50	-.13	.23	.48
additions	5.	-.13	-.02	-.10	-.78	.20	.10	.69
number cancelling	6.	-.04	.07	-.01	-.21	.49	.05	.30
V_1/K	7.	-.70	.16	-.21	-.06	-.07	.19	.60
V_3/K	8.	-.71	.12	-.04	-.05	-.19	.27	.63
S_2/K	9.	-.04	-.05	-.58	-.07	-.02	.19	.38
S_6/K	10.	-.16	.13	-.60	-.15	.06	.05	.43
R_2/K	11.	-.10	.03	-.44	-.27	.13	.46	.50
R_3/OK	12.	-.22	-.13	-.28	-.02	-.04	.53	.43
N_1/K	13.	-.14	.21	-.15	-.74	.26	-.04	.71
N_2/K	14.	-.16	.50	-.10	-.47	.31	.04	.61
general intelligence level as rated by teachers	15.	-.25	.15	-.07	-.04	.12	.42	.28

The six factors for the composite group are interpreted as follows:

Factor I - verbal factor
Factor II - special numerical factor
Factor III - visualization and reasoning
Factor IV - numerical factor
Factor V - perceptual speed
Factor VI - non-verbal reasoning

Even the original factor matrix suggests that the common-factor space of girls has fewer dimensions than that of boys or the composite group, and rotation confirms this assumption.

3.3. The Persuasibility Variables

The writer considered it desirable to include both attitude-dependent and attitude-independent persuasibility tests in the battery. All these tests were constructed by the writer. Where use is made of new measuring instruments, it is important to examine their properties. Only the principal results of the study of the psychometric characteristics of the persuasibility tests will be reported here. For details the reader is referred to the writer's paper entitled "Suostuteltavuuden alue sekä yhteydet älykkyyteen ja informaation lähteisiin" (Niskanen 1964).

The attitude-independent persuasibility tests numbered six. These were named as follows: Picture Teachers, Picture Peers, Picture Parents, Object Teachers, Object Peers, Object Parents. Two persuasibility measurements were undertaken. On the first occasion the subject was presented a number of pictures or objects in pairs. On the second occasion, he was given information about one picture or object in each pair but not about the other. The source of information was also mentioned. The content of information was designed so as to be both affective and cognitive. For instance, on the first occasion subjects had to make a choice between a blue and a yellow extra cover for an exercise book. On the second occasion they were given information: The blue extra cover keeps clean longer. Therefore teachers want you to choose the blue one. Two methods of scoring were applied. First, the difference between a test with information and the corresponding test without information was computed, and this difference was employed as a measure of the adoption of information. Secondly, the original choices made by the subject were postulated to be similar, and use was made of the scores on the tests with information in the final scoring. Properties of the attitude -independent persuasibility tests were investigated as follows:

1. The sums of scores on tests with information and on those without information were compared item by item. This made it possible to identify the items in which information did not occasion changes.

2. The scores of two extreme groups, those who adopted a great deal of information and these who adopted little information were compared item by item. This revealed whether every item discriminated between the subjects whose responses changed greatly and those whose responses changed little.

3. The differences between the means of the scores on the tests with information and those on the corresponding tests without information were tested for statistical significance. The difference proved highly significant for each pair ($p < 0.001$).

4. The split-half reliabilities of the tests were determined. These are presented in the correlation matrix (Table 22).

5. The validities were evaluated by employing the changeability of the subjects' attitudes as rated by teachers as the criterion. The criterion was not dependent on the attitude-independent variables.

6. The intercorrelations of the persuasibility variables and their correlations with certain factor tests of intelligence, attitude tests and trait-rating variables were computed. The information contained in the correlation matrix was utilized in investigating interrelations of variable groups, in structural analyses and in evaluating the measurement techniques.

7. A battery including the persuasibility-test difference variables and certain intelligence, attitude and trait-rating variables was factor-analyzed. The attitude-dependent persuasibility variables spanned a factor on their own, and so did the attitude-independent persuasibility variables.

8. Another battery, including the difference variables measuring attitude-dependent persuasibility, the difference variables obtained by combining sub-tests measuring attitude-independent persuasibility, certain intelligence variables and the changeability of attitudes as rated by teachers, was also factor-analyzed. Factoring was performed by the principal factor method and rotation by the analytic cosine method. The unrotated and rotated factor matrices and factor correlation matrix are presented in Tables 23, 24 and 25 respectively. The attitude-dependent variables spanned a factor and the attitude-independent variables another factor. These factors correlated with each other.

Table 22. Intercorrelations of intelligence, persuasibility and attitude variables, numbers of items and reliabilities.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Opposites	1																					
Synonyms	2	64																				
Word analogies	3	41	47																			
Mathem. problems	4	33	33	24																		
Additions	5	36	38	26	47																	
Number cancelling	6	20	15	11	03	25																
Sibelius,information	7	09	06	02	-15	04	19															
Sibelius,no information	8	02	01	-01	-13	-05	19	83														
Sibelius,change score	9	12	10	04	05	15	-04	23	-34													
Gipsies, information	10	09	11	11	-12	-16	09	39	28	18												
Gipsies,no information	11	16	12	11	04	-12	-01	13	11	06	44											
Gipsies, change score	12	-02	00	05	-20	-08	09	29	20	13	56	-45										
Shift work,information	13	-06	-05	-10	-01	04	-05	03	02	02	-16	-10	-02									
Shift work, no inform.	14	-01	11	03	-07	09	-04	15	09	11	00	03	02	55								
Shift work,change sc.	15	04	17	12	-07	07	-01	15	08	11	14	12	04	-21	70							
Picture peers, inform.	16	06	06	09	-04	-08	-04	08	05	05	17	12	07	-13	-03	08						
Picture teachers,inform.	17	12	13	-01	05	11	04	11	04	14	13	09	03	-03	-08	-06	60					
Picture parents,inform.	18	-03	-08	-10	-04	-05	02	12	11	03	15	07	10	04	03	00	50	49				
Total picture,inform.	19	07	06	00	-01	00	01	12	08	10	18	11	08	-02	-01	00	84	86	77			
Picture differ.,peers	20	12	10	03	01	-01	-01	13	10	06	14	13	03	-11	-02	07	77	52	41	69		
Picture differ.,teachers	21	10	14	05	02	15	04	13	03	20	13	20	-06	-02	05	07	56	77	50	74	54	
Picture differ,parents	22	-05	-09	-02	-15	-01	05	19	19	-01	15	04	11	08	06	00	48	47	71	65	41	41
Total picture differ.	23	07	06	03	-05	06	03	19	13	11	18	16	03	-02	03	06	75	74	68	87	81	82
Object peers,inform.	24	14	04	03	-19	-10	07	10	05	06	20	03	21	-14	-06	04	29	38	34	40	35	40
Object teachers,inform.	25	11	13	05	-05	12	23	39	34	06	20	09	16	-03	10	14	35	51	36	50	37	45
Object parents, inform.	26	22	23	14	05	14	22	36	27	16	25	08	20	-10	00	09	27	45	25	40	30	39
Total object,inform.	27	19	17	09	-07	08	21	35	28	11	27	09	23	-11	02	12	37	55	39	53	42	51
Object differ.,peers	28	07	03	06	-07	-12	01	00	-01	01	21	-01	25	-08	-07	-02	29	34	29	37	33	32
Object differ., teachers	29	15	19	04	-05	-01	16	30	29	01	26	12	19	-10	04	13	41	42	31	46	35	41
Object differ.,parents	30	22	17	19	07	08	19	24	17	12	18	09	10	-11	-10	00	31	35	29	38	29	40
Total object differ.	31	20	17	12	-02	-02	16	25	21	06	29	09	23	-12	-04	06	44	49	39	54	42	49
Attitudes tow. peers	32	07	05	08	09	-04	07	04	00	06	21,	03	26	02	-02	-03	04	04	11	07	02	-01
Attitudes tow. teachers	33	02	-03	-06	-04	-09	04	27	32	-10	23	03	23	07	-03	-09	07	24	26	23	14	16
Attitudes tow. parents	34	09	06	-05	10	08	05	29	24	06	20	06	13	-01	-04	-04	05	09	03	07	12	08
Attitudes tow. mother	35	01	08	05	11	04	04	09	07	01	08	-05	09	05	05	01	08	07	11	10	09	06
Attitudes tow. father	36	06	03	02	15	05	-01	13	10	04	19	-04	20	00	-02	-02	06	01	03	04	10	01
Change in attitudes, as rated by teachers	37	-14	-13	-08	-13	-07	-05	09	02	10	-02	-10	11	-03	04	09	-10	-08	02	-06	-03	-02
Attitudes towards teachers, as rated by teachers	38	-11	-07	-14	03	01	01	06	03	06	-01	-01	-03	-04	03	07	-04	03	-01	00	05	09
Attitudes tow.peers, as rated by teachers	39	-03	02	-12	-04	-01	-04	02	-02	08	-05	-05	-03	-07	03	10	01	09	-02	01	08	12
Sex (0=girl; 1=boy)	40	-12	-07	-10	23	24	-16	-29	-31	06	-37	-22	-16	13	07	-03	-20	-08	-02	-12	-14	-08

22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Reliability	The number of items	Variables
																			82		3
																			67		4
																					5
																					6
																				8	7
																			91	8	8
																			72	8;8	9
																				9	10
																			63	9	11
																			70	9;9	12
																				9	13
																			86	9	14
																			65	9;9	15
																			45	9	16
																			74	8	17
																			50	9	18
																			81	26	19
																			46	9;9	20
																			46	8;8	21
																			45	9;9	22
75																			75	26;26	23
31	44																		53	9	24
37	51	45																	57	8	25
27	40	35	67																68	9	26
39	56	71	88	84															75	26	27
32	40	65	43	30	55														35	9;9	28
29	43	**47**	**73**	**52**	**71**	49													47	8;8	29
25	40	34	45	72	63	28	38												43	9;9	30
37	54	63	71	68	83	75	83	72											66	26;26	31
11	05	06	01	-01	02	05	04	06	07										85	10	32
25	23	15	30	33	32	27	22	20	29	12									88	10	33
06	10	02	19	24	19	03	16	18	17	33	44								76	11	34
10	10	02	13	20	15	-01	04	19	10	34	30	55							82	6	35
-01	04	01	05	22	12	00	04	25	13	25	26	52	68						78	6	36
03	-01	14	06	00	07	01	-01	-02	-01	-02	02	12	10	18							37
01	07	-03	07	05	04	-12	-01	-05	-07	09	16	25	31	30	33						38
-09	05	00	01	02	01	-13	06	-03	-03	03	07	14	07	10	29	61					39
-24	-19	-33	-26	-11	-28	-31	-30	-18	-34	-27	-04	-17	-13	-08	-04	-02	-01				40

N = 165 Significance of correlations (two-tailed)	.10	.05	.02	.01
	.164	.195	.230	.254

Table 23. Factor matrix, intelligence and persuasibility variables. Girls + Boys, N = 165

		I	II	III	IV	V	VI	h^2
Opposites	11	75	02	08	15	-03	13	62
Synonyms	22	77	03	18	06	-15	-02	65
Word analogies	33	57	02	22	09	-10	-09	40
Mathematical problems	44	50	33	-31	-12	-01	11	48
Additions	55	58	20	-16	-27	23	-08	53
Number cancelling	66	26	-09	01	13	42	-13	29
Sibelius, change score	99	15	-12	11	-34	00	15	19
Gipsies, change score	12	-02	-32	31	-02	21	15	26
Shift work, change score	15	12	-11	24	-22	-12	-21	20
Total picture difference	23	18	-63	-32	-10	-12	-07	57
Total object difference	31	27	-69	-11	09	02	06	58
Change in attitudes, as rated by teachers	37	-17	-10	18	-26	04	02	14
Eigenvalues		2,31	1,17	0,53	0,40	0,34	0,16	
Eigenvalues as a percentage of the number of variables		19,3	9,8	4,4	3,3	2,8	1,3	
eigenvalues of cumul. percent		19,3	29,1	33,5	36,8	39,6	40,9	
Product of eigenvalues		2,31	2,70	1,42	0,57	0,19	0,03	

Table 24. Primary factor matrix, intelligence and persuasibility variables. Girls and Boys, N = 165

		I	II	III	IV	V
Opposites	1	64	18	11	-09	11
Synonyms	2	73	14	-02	01	07
Word analogies	3	62	00	00	00	00
Mathematical problems	4	00	69	00	00	00
Additions	5	-06	56	27	28	-07
Number cancelling	6	00	00	52	00	00
Sibelius, change score	9	00	00	00	41	00
Gipsies, change score	12	11	-46	26	21	-01
Shift work, change score	15	22	-16	-12	31	-03
Total picture difference	23	00	00	00	00	75
Total object difference	31	24	-24	20	-08	67
Change in attitudes, as rated by teachers	37	-14	-20	00	35	-11

Table 25. Factor correlation matrix.

det T = -.713

	I	II	III	IV	V
I	1.00	.49	.37	.31	.03
II	.49	1.00	.21	.17	-.02
III	.37	.22	1.00	.04	.09
IV	.31	.17	.04	1.00	.33
V	.03	-.02	.09	.33	1.00
D	.79	.85	.91	.89	.93
rm	.61	.50	.40	.45	.36

On the basis of the analysis of the properties of the variables the writer chose the variables obtained from the combined difference scores on subtests, which were named Total/Picture Difference and Total/Object Difference, as the measures of attitude-independent persuasibility for the present study. These variables spanned a clear-cut factor of attitude-independent persuasibility, and they were more reliable than the subtests. There was a further fact suggesting the use of combined variables: the number of variables was large, and thus it seemed desirable to reduce the dimensionality of each group of variables as far as possible.

The measurement of attitude-dependent persuasibility involves many methodological problems. The writer has discussed these in the article referred to above. Only a brief account will be given below of the principles observed in investigating the measuring instruments devised for the purpose.

Attitude-dependent persuasibility was quantified in such a way that in the first measurement the subjects' attitudes were gauged through Likert-type statements concerning three objects: Sibelius (9 statements), gipsies (14 statements) and shift-work (9 statements). Prior to the second measurement which took place about a month later, the subjects were given unfavourable information about Sibelius and gipsies and unfavourable information about shift-work. The attitudinal differences between the two measurements were computed, and the difference variable thus obtained was used as a measure of the adoption of information.

The properties of the measuring instruments were examined as follows:

1. The distributions of the attitudinal statements were considered.

2. The attitudinal statements were analyzed in regard to their ability to discriminate between subjects with favourable attitudes and those with unfavourable attitudes.

3. The ability of the various subtasks to discriminate between subjects who adopted a great deal of information and those who adopted little information was analyzed.

4. The sums of difference scores were computed for each subtask.

5. The intercorrelations of all the attitudinal statements in each test were computed, and McQuitty's (1957, 1961) method was employed to describe the clustering of the statements. Information was thus obtained on the inner consistency of the set of statements.

6. The difference between the scores on the information and no-information variants of each test was tested for statistical significance. All three differences were highly significant ($p < .001$)

7. The estimates of the reliabilities of the no-information variants of the tests were computed from the correlation matrix by Spearman-Brown's prediction formula (McNemar 1962). The reliabilities of the difference variables were determined by the split-half method. The reliabilities are presented in the correlation-matrix (Table 22).

8. The validity of the tests was examined by employing the ratings given by teachers as the criterion. The validity correlations were low. In factor analysis, the changeability of attitudes, as rated by the teachers, was loaded on the attitude-dependent persuasibility factor.

In addition, the correlation and factor analytical techniques described above were used to analyze the attitude -dependent persuasibility variables. A single factor was spanned by these variables in the factor analyses performed.

On the basis of the analysis of the properties of the attitude-dependent persuasibility variables the writer decided to use the differences betwcen the scores on the information and no-information variants of the tests as the measures of attitude-dependent persuasibility in the present study. The variables were named as follows: change score on the Sibelius Test, change score on the Gipsies Test and change score on the Shift-work Test.

3.4. The Attitude Variables

The choice of attitude variables for the present study was guided by certain assumptions on the interrelations of school achievement and attitudes, on the one hand, and by a desire to use the same variables in information source measurements also. The measuring instruments were of the Likert -type, and the attitudes concerned were those towards teachers, peers, parents, father and mother. The Teacher and Peer tests were constructed by the present writer, whereas the Parents, Father and Mother tests were translations, made by the writer, of those in Elias's battery (Elias 1954). A detailed account of the analysis of these attitude tests can be found in the writer's paper "Suostuteltavuuden alue sekä yhteydet älykkyyteen ja informaation lähteisiin" (Niskanen 1964). Only the principles observed in analyzing the tests will be presented here. In the case of each test, the intensity-value distributions for the various items and the discriminati power of every item were considered. In addition, the intercorrelations of the subtasks were computed, and McQuitty's (1957, 1961) method was used to discover how the subtasks were clustered. The Spearman-Brown formula was employed to obtain estimates of the reliabilities of the tests from the correlations. The estimates were as follows:

Teachers test	88
Peers test	85
Parents test	76
Mother test	82
Father test	78

The validity of the Teachers and Peers test was examined by employing the ratings done by teachers as the criterion. The correlations of the tests with the criterion were low. In factor analysis, on the other hand, the attitudes towards the teacher variable as rated by teachers obtained a loading on the attitude factor. The validity problem of attitude measurements is a complicated one. Validity is interrelated with the way in which various components of attitudinal behaviour are defined. The present writer has discussed this validity problem in the paper referred to above.

3.5. The Sociometric Variables

These were obtained from choices made by the pupils, who were requested to choose a leader for an excursion and a room-mate in the test situation. The principal methodological problem encountered in scoring the room-mate choices was how to combine the negative and positive choices. The Preliminary investigation undertaken by the writer revealed that the factual positive and negative choices did not behave in such a way as they were expected to do on logical grounds. Therefore, only positive room-mate choices were used for purposes of scoring. Quantitative information is not available on the psychometric characteristics of the sociometric variables included in the present study. This restricts the use of the information obtained by means of these variables.

3.6. Pupils' Traits as Rated by Teachers

Apart from those mentioned in describing the school achievement, intelligence, persuasibility and attitudinal variables, ratings by teachers on the following four traits were used in this study: attitude towards other people, attitude towards work, emotional balance and activity. In each case, use was made of a five-point scale, and the ratings were required to be normally distributed. The extreme categories were characterized as follows:

Attitude towards other people: 1. shut-in, shy, isolative; 5. open-minded, lively, sociable.

Attitude towards work: 1. careless, neglectful, does not concentrate on work; 5. careful, with a sense of responsibility, industrious.

Emotional balance: 1. unbalanced, incapable of adjustment, conflict-ridden; 5. balance, capable of adjustment, free from conflicts.

Activity: 1. listless, without initiative, inefficient; 5. energetic, with initiative, alert.

Traits like these are not very easy to rate. There is the possibility that all raters do not have the same characteristics in mind when they give their ratings. Therefore, the teachers who did the ratings were given detailed descriptions of the traits they were supposed to rate. The halo effect is also likely to distort the rating of such traits. The part possibly played by the halo effect can be estimated from the results of the factor analyses to be reported later. The original research design included plans for the quantification of reliability, but this part of the project was not realized. A great many additional measurements would have been necessary had an attempt been made to construct validity criteria for the ratings. No such attempt was made, however, in the present study.

3.7. The Dexterity Variables

The dexterity variables selected for the study were intended to measure a general dexterity factor rather than any specific factor of dexterity. The tests chosen were an Ornament Test and a Wire-bending Test. According to Heinonen (1957), tests of this kind are loaded on the general dexterity factor. These tests measure dexterity, eye-hand coordination and the degree of differentiation of perceptions. The tests were time-limited, and the scoring took place on a qualitative basis. The tests can be regarded as parallel tests, and their intercorrelation can thus be interpreted as a reliability coefficient. This correlation was .48 for the girl groups, .41 for the boy groups and .51 for the combined group. Thus, the correlations were comparatively low. It should be pointed out, however, that the estimates of reliability obtained by the parallel-test technique can be taken to indicate the lower limit of reliability.

3.8. Social Status and the Number of Siblings

Two variables related to the home, Social Status and the Number of Siblings, were included in the study. The first variable reflected the occupation of the subject's father and/or mother. In the second variable not only the subject's sisters and/or brothers but also the step-sisters and step-brothers that were or had been living in the same home were taken into account.

4. Interrelations between School Achievement and Intelligenc in the Light of Correlations and Factor Analyses

Intelligence has been supposed to play a pivotal role in the explanation of school achievement. Interrelations betwee these two will be considered below.

Table 26. Correlationmatrix, all variables included in the study.
Girls, N = 86

1. carefulness	1	1.00												
2. religion	1	.57	2	1.00										
3. reading and literature	1	.52	2	.54	3	1.00								
4. composition	1	.41	2	.45	3	.62	4	1.00						
5. civics	1	.67	2	.71	3	.57	4	.50	5	1.00				
6. mathematics	1	.63	2	.50	3	.56	4	.44	5	.67	6	1.00		
7. book-keeping	1	.63	2	.58	3	.46	4	.42	5	.68	6	.70	7	1.0
8. home economics	1	.40	2	.26	3	.14	4	.17	5	.38	6	.32	7	.2
	8.	1.00												
9. physical education	1	.26	2	.20	3	.30	4	.11	5	.09	6	.09	7	.1
	8	.09	9	1.00										
10. handcrafts	1	.54	2	.38	3	.39	4	.33	5	.40	6	.39	7	.3
	8	.28	9	.22	10	1.00								
11. vocational guidance	1	.57	2	.62	3	.58	4	.52	5	.76	6	.59	7	.6
	8	.29	9	.04	10	.44	11	1.00						
12. music	1	-.00	2	-.11	3	-.06	4	,08	5	-.14	6	-.10	7	-.1
	8	-.00	9	.12	10	-.04	11	-.13	12	1.00				
13. penmanship	1	.26	2	.24	3	.22	4	.27	5	.10	6	.04	7	.1
	8	.04	9	.26	10	.16	11	.04	12	.13	13	1.00		
14. drawing	1	.17	2	.18	3	.02	4	.12	5	.12	6	.05	7	.1
	8	.01	9	.43	10	.24	11	.02	12	.08	13	.21	14	1.0
15. mean	1	.78	2	.72	3	.66	4	.58	5	.85	6	.73	7	.8
	8	.44	9	.29	10	.50	11	.78	12	-.01	13	.19	14	.
	15	1.00												
16. opposites	1	.25	2	.29	3	.56	4	.34	5	.31	6	.35	7	.
	8	.14	9	.40	10	.14	11	.29	12	-.02	13	.08	14	.
	15	.44	16	1.00										
17. synonyms	1	.30	2	.28	3	.53	4	.39	5	.37	6	.36	7	.
	8	.07	9	.38	10	.25	11	.39	12	.00	13	.06	14	.
	15	.52	16	.65	17	1.00								
18. word analogies	1	.16	2	.19	3	.37	4	.23	5	.25	6	.23	7	.
	8	.16	9	-.03	10	.20	11	.29	12	-.07	13	.04	14	-.
	15	.31	16	.45	17	.39	18	1.00						
19. mathemathical problems	1	-.03	2	.14	3	.37	4	.06	5	.16	6	.37	7	.
	8	-.02	9	.19	10	.11	11	.23	12	-.03	14	-.08	15	.
	16	.42	17	.47	18	.30	19	1.00						
20. additions	1	.29	2	.22	3	.44	4	.08	5	.21	6	.32	7	.
	8	.13	9	.40	10	.26	11	.18	12	-.13	14	.08	15	.
	16	.60	17	.42	18	.22	19	.38	20	1.00				
21. number cancelling	1	.12	2	.21	3	.20	4	.09	5	.11	6	.19	7	.
	8	.10	9	.27	10	.23	11	.19	12	-.14	13	-.00	14	.
	15	.20	16	.31	17	.14	18	.08	19	-.01	20	.32	21	1.
22. V_1/K	1	.17	2	.27	3	.46	4	.37	5	.36	6	.35	7	
	8	.23	9	.19	10	.20	11	.24	12	.04	13	.04	14	
	15	.41	16	.45	17	.50	18	.41	19	.39	20	.22	21	-
	22	1.00												
23. V_3/K	1	.26	2	.24	3	.44	4	.34	5	.36	6	.33	7	
	8	.17	9	.16	10	.29	11	.27	12	-.03	13	-.01	14	
	15	.40	16	.45	17	.48	18	.38	19	.32	19	.32	20	
	21	-.06	22	.56	23	1.00								

(Table 26 continues)

24. S_2/K	1	.15	2	.14	3	.27	4	.22	5	.36	6	.32
	7	.36	8	.09	9	.11	10	.39	11	.32	12	-.02
	13	-.05	14	.28	15	.36	16	.14	17	.29	18	.28
	19	.29	20	.17	21	-.03	22	.28	23	.30	24	1.00
25. S_6/K	1	-.01	2	.02	3	.09	4	.10	5	.14	6	.22
	7	.20	8	-.09	9	.03	10	.12	11	.03	12	.02
	13	-.01	14	.25	15	.09	16	.12	17	.17	18	.31
	19	.25	20	.16	21	.12	22	.30	23	.17	24	.45
	25	1.00										
26. R_2/K	1	.04	2	.04	3	.27	4	.13	5	.18	6	.27
	7	.17	8	.15	9	.04	10	.20	11	.20	12	-.03
	13	-.05	14	.00	15	.25	16	.18	17	.27	18	.30
	19	.34	20	.16	21	.13	22	.33	23	.19	24	.35
	25	.26	26	1.00								
27. R3/OK	1	.02	2	.10	3	.23	4	.26	5	.10	6	.18
	7	.20	8	-.07	9	.00	10	.19	11	.13	12	.14
	13	-.07	14	.23	15	.16	16	.18	17	.21	18	.32
	19	.34	20	.08	21	-.11	22	.32	23	.40	24	.42
	25	.26	26	.37	27	1.00						
28. N_1/K	1	.36	2	.28	3	.50	4	.21	5	.30	6	.47
	7	.33	8	.13	9	.33	10	.18	11	.25	12	-.12
	13	.15	14	-.01	15	.35	16	.55	17	.40	18	.29
	19	.35	20	.70	21	.36	22	.26	23	.07	24	.10
	25	.20	26	.22	27	.04	28	1.00				
29. N_2/K	1	.27	2	.10	3	.38	4	.25	5	.26	6	.50
	7	.26	8	.11	9	.08	10	.07	11	.26	12	-.18
	13	.07	14	-.06	15	.26	16	.33	17	.25	18	.37
	19	.15	20	.41	21	.34	22	.23	23	.07	24	.11
	25	.29	26	.19	27	-.07	28	.58	29	1.00		
30. general intelligence level as rated by teachers	1	.43	2	.37	3	.45	4	.63	5	.53	6	.50
	7	.54	8	.27	9	.07	10	.32	11	.50	12	-.04
	13	.14	14	.11	15	.62	16	.29	17	.32	18	.18
	19	.10	20	.06	21	.05	22	.22	23	.31	24	.29
	25	.02	26	.12	27	.19	28	.04	29	.11	30	1.00
31. Sibelius	1	.05	2	.12	3	.07	4	.10	5	.12	6	-.11
	7	.05	8	.03	9	.05	10	-.02	11	.13	12	.07
	13	.04	14	.05	15	.11	16	.22	17	.14	18	.17
	19	.00	20	.01	21	.03	22	.02	23	.07	24	-.04
	25	.03	26	.01	27	-.02	28	.07	29	-.05	30	-.02
	31	1.00										
32. gipsies	1	.10	2	-.00	3	.14	4	.05	5	.06	6	-.01
	7	-.00	8	-.06	9	.03	10	-.04	11	.15	12	-.10
	13	-.04	14	-.10	15	.06	16	.01	17	.08	18	-.00
	19	-.10	20	.04	21	.13	22	-.17	23	-.12	24	-.11
	25	.07	26	.00	27	-.17	28	.04	29	,26	30	.08
	31	.18	32	1.00								
33. shift work	1	.25	2	.14	3	.18	4	.07	5	.15	6	.05
	7	.12	8	.15	9	.03	10	.00	11	.17	12	-.09
	13	-.01	14	-.20	15	.22	16	.06	17	.13	18	.16
	19	-.04	20	.13	21	-.08	22	.08	23	.21	24	-.19
	25	-.20	26	.02	27	-.09	28	.16	29	.06	30	.07
	31	.10	32	.03	33	1.00						
34. picture	1	.07	2	.04	3	.05	4	-.00	5	-.06	6	.04
	7	.12	8	.09	9	.21	10	-.13	11	-.02	12	-.06
	13	.02	14	.12	15	.06	16	.03	17	.08	18	.04
	19	-.10	20	.12	21	.00	22	.09	23	-.08	24	.05
	25	.04	26	.06	27	.08	28	.08	29	.12	30	-.10
	31	.13	32	.04	33	.12	34	1.00				

(Table 26 continues)

35. object	1	.11	2	.17	3	.20	4	.04	5	.10	6	.01
	7	.23	8	.03	9	.12	10	.04	11	.17	12	-.16
	13	-.02	14	.05	15	.15	16	.17	17	.27	18	.18
	19	-.00	20	.13	21	.08	22	.12	23	.03	24	.06
	25	.02	26	.16	27	.02	28	.05	29	.14	30	.10
	31	.17	32	.29	33	.12	34	.55	35	1.00		
36. attitudes towards peers	1	-.10	2	-.01	3	.04	4	-.00	5	-.06	6	-.06
	7	-.10	8	-.22	9	.09	10	-.04	11	-.04	12	.03
	13	.03	14	.04	15	-.06	16	.11	17	.06	18	.09
	19	.20	20	.14	21	.08	22	-.04	23	.01	24	.01
	25	.01	26	-.03	27	.08	28	-.06	29	-.01	30	.00
	31	.10	32	.23	33	-.08	34	.05	35	.09	36	1.00
37. attitudes towards teachers	1	.06	2	.09	3	.00	4	-.05	5	.00	6	-.05
	7	.00	8	-.12	9	.05	10	.00	11	.04	12	-.11
	13	.02	14	.09	15	-.00	16	-.06	17	.08	18	-.04
	19	-.03	20	.06	21	.00	22	.01	23	.00	24	.08
	25	-.08	26	.06	27	.11	28	-.10	29	.06	30	.06
	31	.01	32	.28	33	.04	34	.39	35	.46	36	.20
	37	1.00										
38. attitudes towards parents	1	.15	2	.23	3	.10	4	.04	5	.11	6	.22
	7	.16	8	-.18	9	.24	10	.04	11	.16	12	-.06
	13	.07	14	.15	15	.13	16	.08	17	.15	18	-.12
	19	.13	20	.18	21	.04	22	.02	23	.07	24	.04
	25	-.09	26	.04	27	.14	28	.04	29	.09	30	.15
	31	.03	32	.19	33	-.03	34	.18	35	.24	36	.33
	37	.60	38	1.00								
39. attitudes towards mother	1	.18	2	.15	3	.10	4	.09	5	.00	6	.12
	7	.11	8	-.11	9	.24	10	.05	11	.04	12	-.04
	13	.15	14	.11	15	.06	16	.03	17	.13	18	.02
	19	.21	20	.17	21	.01	22	-.00	23	.09	24	-.06
	25	-.06	26	-.12	27	.10	28	.15	29	.12	30	-.01
	31	-.00	32	.15	33	.10	34	.14	25	.07	36	.50
	37	.31	38	.48	39	1.00						
40. attitudes towards father	1	.25	2	.18	3	.19	4	.08	5	.04	6	.20
	7	.11	8	-.06	9	.17	10	.07	11	.12	12	-.12
	13	.10	14	.16	15	.06	16	.13	17	.11	18	.06
	19	.21	20	.22	21	.06	22	-.02	23	.16	24	-.01
	25	.02	26	-.03	27	.14	28	.20	29	.20	30	.00
	31	.06	32	.31	33	.04	34	.11	35	.16	36	.34
	37	.35	38	.43	39	.72	40	1.00				
41. attitude change as rated by teachers	1	.29	2	.23	3	.02	4	.06	5	.36	6	.16
	7	.23	8	.22	9	.08	10	.19	11	.36	12	-.15
	13	-.07	14	.11	15	.24	16	-.09	17	-.02	18	-.08
	19	.04	20	-.02	21	-.02	22	-.03	23	-.01	24	.06
	25	-.09	26	.00	27	.10	28	.03	29	-.07	30	.10
	31	.08	32	-.00	33	.01	34	.09	35	.06	36	-.06
	37	.21	38	.19	39	.12	40	.16	41	1.00		
42. attitudes towards teachers as rated by teachers	1	.45	2	.26	3	.07	4	-.01	5	.34	6	.32
	7	.34	8	.21	9	.12	10	.20	11	.37	12	-.10
	13	-.08	14	.11	15	.28	16	-.13	17	-.03	18	-.13
	19	.12	20	.07	21	.05	22	-.13	23	-.02	24	.17
	25	.01	26	.03	27	.03	28	.17	29	.02	30	.00
	31	.03	32	-.04	33	-.06	34	.05	35	-.07	36	-.05
	37	.10	38	.16	39	.26	40	.26	41	.58	42	1.00

(Table 26 continues)

43. attitudes towards peers as rated by teachers	1	.46	2	.30	3	.04	4	.03	5	.45	6	.33
	7	.33	8	.18	9	.13	10	.23	11	.34	12	.03
	13	-.08	14	.11	15	.36	16	-.04	17	.04	18	-.16
	19	.05	20	.04	21	.04	22	-.03	23	.05	24	.06
	25	-.04	26	.07	27	-.00	28	.10	29	-.11	30	.09
	31	.09	32	-.18	33	.01	34	-.05	35	-.05	36	-.14
	37	.04	38	.10	39	-.03	40	.00	41	.55	42	.66
	43	1.00										
44. ornaments	1	.10	2	.11	3	.23	4	.14	5	.25	6	.22
	7	.30	8	.12	9	.05	10	.24	11	.26	12	-.06
	13	.01	14	.36	15	.30	16	.15	17	.16	18	.24
	19	.27	20	.10	21	-.10	22	.31	23	.39	24	.47
	25	.35	26	.34	27	.37	28	.12	29	.02	30	.17
	31	.04	32	-.08	33	-.05	34	.07	35	.04	36	-.14
	37	-.14	38	-.15	39	-.08	40	-.01	41	.01	42	.04
	43	-.01	44	1.00								
45. wire bending	1.	.06	2	.03	3	.07	4	.10	5	.03	6	.09
	7	.08	8	.01	9	.19	10	.23	11	.01	12	.12
	13	.21	14	.44	15	.10	16	.02	17	.05	18	-.02
	19	.10	20	.07	21	-.11	22	.09	23	.13	24	.32
	25	.12	26	.13	27	.20	28	-.03	29	-.16	30	.08
	31	-.02	32	-.16	33	-.17	34	-.01	35	-.12	36	-.02
	37	-.19	38	.00	39	-.13	40	-.10	41	-.09	42	-.02
	43	-.04	44	.50	45	1.00						
46. attitudes towards other people	1	-.23	2	-.04	3	.12	4	.14	5	-.13	6	-.05
	7	.00	8	-.08	9	.15	10	-.23	11	-.10	12	.17
	13	.11	14	.10	15	-.01	16	.22	17	.12	18	.20
	19	.11	20	.09	21	.12	22	.01	23	.17	24	.05
	25	.08	26	.11	27	.23	28	.02	29	.10	30	.18
	31	.03	32	.03	33	.03	34	.07	35	.02	36	.14
	37	-.08	38	-.03	39	.07	40	.04	41	-.28	42	-.25
	43	-.31	44	.01	45	.12	46	1.00				
47. attitudes towards work	1	.64	2	.37	3	.23	4	.37	5	.56	6	.48
	7	.57	8	.30	9	-.06	10	.44	11	.55	12	-.11
	13	.18	14	.11	15	.60	16	.10	17	.19	18	.17
	19	-.14	20	.11	21	-.01	22	-.00	23	.10	24	.28
	25	-.04	26	.09	27	.04	28	.13	29	.19	30	.51
	31	.05	32	.14	33	.01	34	-.02	35	.08	36	-.11
	37	.09	38	.14	39	.06	40	.10	41	.20	42	.32
	43	.29	44	.17	45	.07	46	-.11	47	1.00		
48. emotional balance	1	.52	2	.24	3	.25	4	.17	5	.43	6	.36
	7	.55	8	.23	9	.08	10	.34	11	.49	12	-.03
	13	.09	14	.14	15	.51	16	.16	17	.25	18	.06
	19	-.04	20	.11	21	.00	22	-.02	23	.09	24	.27
	25	-.02	26	.03	27	.06	28	.14	29	.11	30	.23
	31	.03	32	.05	33	.01	34	.11	35	.10	36	-.11
	37	.02	38	.09	39	.11	40	.08	41	.29	42	.42
	43	.33	44	.11	45	-.04	46	-.06	47	.67	48	1.00
49. activity	1	.05	2	.06	3	.28	4	.32	5	.17	6	.15
	7	.20	8	.08	9	.10	10	.03	11	.18	12	.18
	13	.11	14	.10	15	.29	16	.27	17	.30	18	.32
	19	.16	20	.15	21	.07	22	.10	23	.25	24	.19
	25	.09	26	.29	27	.34	28	.12	29	.10	30	.36
	31	.08	32	.08	33	..07	34	-.10	35	-.03	36	-.02
	37	-.16	38	-.02	39	.04	40	.06	41	-.14	42	-.02
	43	-.13	44	.13	45	.06	46	.70	47	.25	48	.25
	49	1.00										

(Table 26 continues)

50. leadership	1	-.05	2	106	3	.21	4	.32	5	.15	6	.04
	7	-.04	8	.12	9	.18	10	.15	11	.12	12	.10
	13	-.09	14	.09	15	.15	16	.13	17	.05	18	.01
	19	.03	20	-.06	21	.08	22	.25	23	.25	24	.20
	25	.08	26	.15	27	.15	28	-.04	29	-.09	30	.31
	31	-.10	32	-.01	33	-.03	34	-.19	35	-.21	36	-.02
	37	-.11	38	-.11	39	-.11	40	-.15	41	.08	42	-.05
	43	-.02	44	.14	45	.13	46	.35	47	-.00	48	-.10
	49	.29	50	1.00								
51. companionship	1	.09	2	.11	3	.17	4	.21	5	.08	6	.09
	7	.16	8	.16	9	.15	10	.12	11	.21	12	.05
	13	-.12	14	-.00	15	.21	16	.11	17	.17	18	.10
	19	.10	20	.07	21	.12	22	.17	23	.20	24	.19
	25	.10	26	.17	27	.21	28	.02	29	.03	30	.30
	31	.01	32	.03	33	.14	34	.06	35	.00	36	.04
	37	.06	38	.00	39	-.00	40	.06	41	-.04	42	.06
	43	.09	44	.13	45	.01	46	.27	47	.09	48	-.00
	49	.26	50	.42	51	1.00						
52. social status	1	-.19	2	-.31	3	-.18	4	-.07	5	-.32	6	-.34
	7	-.26	8	-.21	9	-.01	10	-.09	11	-.26	12	.00
	13	.03	14	.06	15	-.33	16	.00	17	-.05	18	-.14
	19	-.23	20	.08	21	-.13	22	-.21	23	-.08	24	-.06
	25	-.19	26	-.15	27	-.03	28	-.08	29	.00	30	-.04
	31	.07	32	.11	33	-.02	34	.04	35	.04	36	.11
	37	.08	38	.05	39	.06	40	.11	41	-.11	42	-.12
	43	-.28	44	-.09	45	-.04	46	.15	47	.11	48	.06
	49	.07	50	-.10	51	-.10	52	1.00				
53. number of siblings	1	-.20	2	-.04	3	-.14	4	-.12	5	-.12	6	-.07
	7	-.18	8	-.11	9	.04	10	-.04	11	-.14	12	.06
	13	.02	14	.06	15	-.12	16	-.15	17	-.00	18	-.10
	19	-.00	20	-.12	21	.04	22	-.11	23	-.23	24	-.00
	25	.01	26	.03	27	-.12	28	-.07	29	-.09	30	-.14
	31	.01	32	.04	33	-.09	34	.10	35	.08	36	-.07
	37	.06	38	-.01	39	-.08	40	-.10	41	-.01	42	-.12
	43	-.09	44	.00	45	-.01	46	-.07	47	-.09	48	-.11
	49	-.09	50	-.03	51	-.17	52	.11	53	1.00		

Level of significance for two-tailed test:	.05	.01
	.21	.27

Table 27. Correlationmatrix, all variables included in the study: Boys, N = 69

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. carefulness	1.00																				
2. religion	.53	1.00																			
3. reading and literature	.31	.45	1.00																		
4. composition	.44	.38	.52	1.00																	
5. civics	.65	.59	.45	.50	1.00																
6. mathematics	.62	.41	.27	.48	.70	1.00															
7. book-keeping	.62	.43	.18	.48	.44	.51	1.00														
8. home economics	.43	.26	.18	.15	.32	.25	.24	1.00													
9. physical education	.18	.29	.30	.36	.19	.18	.33	.16	1.00												
10. handcrafts	.41	.15	.23	.27	.35	.35	.37	.31	.19	1.00											
11. vocational guidance	.66	.56	.32	.39	.74	.63	.57	.41	.24	.39	1.00										
12. music	.03	.23	.28	.24	.12	.01	.06	.03	.36	-.13	.14	1.00									
13. penmanship	.19	.23	.22	.45	.16	.18	.18	.03	.40	.19	.24	.31	1.00								
14. drawing	.31	.22	.32	.33	.35	.31	.18	.39	.26	.30	.35	.26	.35	1.00							
15. mean	.76	.59	.46	.53	.73	.71	.70	.52	.40	.55	.79	.04	.28	.45	1.00						
16. opposites	-.15	-.08	.25	.35	-.07	-.02	.05	-.17	.27	.03	-.18	.30	.21	-.01	-.07	1.00					
17. synonyms	-.12	.04	.20	.45	-.01	-.03	.05	-.28	.15	-.18	-.15	.20	.09	-.13	-.10	.59	1.00				
18. word analogies	-.08	-.04	.19	.32	.03	.10	.05	-.24	-.11	-.10	-.12	-.16	.02	.00	-.03	.29	.45	1.00			
19. mathemathical problems	.04	.13	.12	.38	.21	.49	.21	.07	.08	-.05	.18	.12	.02	.09	.25	.28	.21	.17	1.00		
20. additions	.05	.08	.21	.44	.20	.36	.21	-.05	.12	-.00	.13	.12	.13	-.17	.15	.23	.37	.36	.47	1.00	
21. number cancelling	-.03	.08	.06	.18	.13	.17	.18	-.01	.16	.11	.12	.10	.17	.14	.14	.09	.19	.20	.23	.34	1.00

(Table 27 continues)

22. V_1/K	1	.01	2	.15	3	.27	4	.35	5	.20	6	.19
	7	.03	8	-.09	9	-.12	10	-.08	11	.01	12	.14
	13	.03	14	.11	15	.06	16	.35	17	.54	18	.36
	19	.35	20	.15	21	.11	22	1.00				
23. V_3/K	1	.00	2	.22	3	.23	4	.42	5	.18	6	.16
	7	-.00	8	-.12	9	.01	10	-.02	11	-.06	12	.07
	13	-.02	14	-.02	15	.03	16	.28	17	.58	18	.29
	19	.35	20	.17	21	-.03	22	.63	23	1.00		
24. S_2/K	1	.06	2	-.12	3	.07	4	-.01	5	.11	6	.19
	7	.17	8	.17	9	-.24	10	.22	11	.08	12	-.01
	13	-.15	14	.16	15	.11	16	.13	17	-.08	18	.00
	19	.26	20	.05	21.	.05	22	.05	23	-.01	24	1.00
25. S_2/K	1	.01	2	.01	3	.07	4	.22	5	.05	6	.14
	7	.13	8	.05	9	-.24	10	-.08	11	-.02	12	-.04
	13	-.12	14	.01	15	.06	16	.13	17	.38	18	.38
	19	.30	20	.29	21	.17	22	.36	23	.17	24	.34
	25	1.00										
26. R_2/K	1	.16	2	.09	3	.14	4	.37	5	.32	6	.50
	7	.33	8	.14	9	.08	10	.21	11	.22	12	.05
	13	.19	14	.12	15	.34	16	.24	17	.26	18	.33
	19	.48	20	.50	21	.30	22	.27	23	.17	24	.39
	25	.42	26	1.00								
27. R_3/OK	1	.09	2	.12	3	.16	4	.30	5	.16	6	.32
	7	.20	8	.03	9	.22	10	.21	11	.05	12	.02
	13	.21	14	.17	15	.20	16	.18	17	.26	18	.27
	19	.13	20	.21	21	.16	22	.25	23	.23	24	.04
	25	.19	26	.52	27	1.00						
28. N_1/K	1	.03	2	-.02	3	.05	4	.34	5	.13	6	.36
	7	.05	8	-.03	9	-.08	10	.04	11	.05	12	-.07
	13	.12	14	-.06	15	.04	16	.09	17	.20	18	.30
	19	.45	20	.68	21	.21	22	.10	23	.13	24	.14
	25	.32	26	.39	27	.04	28	1.00				
29. N_2/K	1	.15	2	.22	3	.13	4	.33	5	.27	6	.37
	7	.22	8	-.07	9	.20	10	-.04	11	.20	12	.07
	13	.18	14	-.04	15	.24	16	.14	17	.24	18	.23
	19	.38	20	.55	21	.18	22	.15	23	.26	24	.05
	25	.19	26	.41	27	.07	28	.62	29	1.00		
30. general intelligence level as rated by teachers	1	.49	2	.44	3	.32	4	.52	5	.66	6	.72
	7	.54	8	.29	9	.27	10	.26	11	.59	12	.11
	13	.10	14	.26	15	.69	16	.08	17	.19	18	.23
	19	.38	20	.25	21	.19	22	.32	23	.26	24	.10
	25	.24	26	.48	27	.29	28	.18	29	.32	30	1.00
31. Sibelius	1	.00	2	-.06	3	-.06	4	-.04	5	-.11	6	-.03
	7	-.14	8	-.05	9	.03	10	-.21	11	-.11	12	.24
	13	.04	14	-.17	15	-.08	16	.04	17	.08	18	-.15
	19	.03	20	.20	21	-.00	22	-.02	23	.12	24	.01
	25	.09	26	-.03	27	-.07	28	.07	29	.29	30	-.03
	31	1.00										
32. gipsies	1	-.06	2	-.17	3	-.03	4	-.20	5	-.02	6	-.09
	7	-.10	8	.01	9	-.08	10	-.00	11	-.00	12	-.12
	13	-.12	14	-.03	15	-.14	16	-.15	17	-.18	18	-.04
	19	-.09	20	-.07	21	-.08	22	.00	23	-.17	24	.10
	25	.17	26	-.16	27	-.07	28	-.04	29	-.07	30	-.15
	31	.13	32	1.00								

(Table 27 continues)

33. shift work	1	.09	2	.17	3	.24	4	.18	5	.09	6	.02
	7	.10	8	-.04	9	.07	10	-.13	11	.13	12	.06
	13	-.07	14	.09	15	.15	16	-.02	17	.16	18	.02
	19	-.06	20	.07	21	.09	22	.12	23	-.00	24	-.18
	25	.16	26	-.17	27	-.13	28	-.04	29	.08	30	.07
	31	.13	32	-.03	33	1.00						
34. picture	1	.14	2	.08	3	-.06	4	.16	5	.05	6	.23
	7	.31	8	.18	9	.01	10	-.03	11	.08	12	-.12
	13	.02	14	-.05	15	.16	16	.08	17	.02	18	-.03
	19	.16	20	.06	21	.02	22	.18	23	.15	24	-.05
	25	.04	26	.03	27	.00	28	.18	29	.26	30	.21
	31	.04	32	-.01	33	-.01	34	1.00				
35. object	1	-.04	2	-.01	3	-.07	4	.10	5	-.01	6	.12
	7	.17	8	-.11	9	-.04	10	-.10	11	-.02	12	.12
	13	-.04	14	-.03	15	-.09	16	.11	17	.01	18	-.07
	19	.18	20	-.01	21	.12	22	.10	23	.09	24	-.08
	25	-.15	26	-.08	27	-.01	28	.05	29	.00	30	.02
	31	-.12	32	-.08	33	-.05	34	.48	35	1.00		
36. attitudes towards peers	1	.12	2	-.02	3	.10	4	.07	5	.17	6	.19
	7	.21	8	.23	9	.05	10	.12	11	.14	12	-.12
	13	-.07	14	.13	15	.25	16	.03	17	.03	18	.07
	19	.16	20	.02	21	.20	22	.02	23	.02	24	.28
	25	.34	26	.23	27	.02	28	.11	29	.09	30	.27
	31	.09	32	.16	33	-.01	34	.04	35	-.09	36	1.00
37. attitudes towards teachers	1	.16	2	-.11	3	.04	4	.08	5	-.00	6	.06
	7	.24	8	.17	9	.16	10	.29	11	.11	12	-.09
	13	.12	14	.08	15	.11	16	.08	17	-.12	18	-.07
	19	.03	20	-.10	21	.07	22	-.07	23	-.10	24	.06
	25	-.19	26	.02	27	.05	28	-.02	29	-.10	30	-.07
	31	-.20	32	.11	33	-.26	34	.07	35	.15	36	.02
	37	1.00										
38. attitudes towards parents	1	.20	2	-.11	3	.02	4	.16	5	.24	6	.23
	7	.10	8	.06	9	-.13	10	-.02	11	.16	12	.04
	13	.04	14	.01	15	.15	16	.08	17	-.02	18	.05
	19	.16	20	.17	21	-.01	22	-.04	23	-.00	24	.18
	25	.07	26	.27	27	-.03	28	.06	29	.04	30	.05
	31	.09	32	-.00	33	-.07	34	.01	35	-.00	36	.23
	37	.29	38	1.00								
39. attitudes towards mother	1	.16	2	.03	3	.09	4	-.06	5	.24	6	.10
	7	.06	8	.00	9	-.23	10	-.00	11	.16	12	-.02
	13	-.09	14	-.06	15	.07	16	-.06	17	.01	18	.08
	19	.04	20	.05	21	.05	22	-.00	23	.01	24	.10
	25	-.02	26	.10	27	-.00	28	.04	29	.05	30	.03
	31	.05	32	.03	33	-.13	34	.06	35	.06	36	.19
	37	.28	38	.60	39	1.00						
40. attitudes towards father	1	.12	2	-.16	3	-.00	4	-.11	5	.15	6	.14
	7	-.09	8	.13	9	-.30	10	-.01	11	.14	12	-.00
	13	-.20	14	-.00	15	.01	16	-.07	17	-.12	18	-.10
	19	.07	20	-.00	21	-.20	22	-.13	23	-.14	24	.18
	25	.05	26	.10	27	-.05	28	.05	29	.00	30	-.04
	31	.06	32	.11	33	-.11	34	-.01	35	-.00	36	.16
	37	.17	38	.65	39	.60	40	1.00				

(Table 27 continues)

41. attitude change as rated by teachers	1	-.17	2	-.18	3	-.08	4	-.33	5	-.34	6	-.32
	7	-.28	8	.08	9	-.26	10	-.23	11	-.22	12	-.14
	13	-.23	14	-.22	15	-.23	16	-.22	17	-.23	18	-.08
	19	-.26	20	-.05	21	-.12	22	-.29	23	-.41	24	-.04
	25	.04	26	-.13	27	-.22	28	-.11	29	-.20	30	-.30
	31	.09	32	.08	33	.12	34	-.16	35	-.18	36	-.02
	37	-.19	38	.05	39	.02	40	.19	41	1.00		
42. attitudes towards teachers as rated by teachers	1	.67	2	.30	3	.22	4	.21	5	.46	6	.38
	7	.44	8	.45	9	.18	10	.36	11	.52	12	.12
	13	.09	14	.34	15	.58	16	-.10	17	-.11	18	-.17
	19	-.03	20	.01	21	-.00	22	-.07	23	-.13	24	.05
	25	.04	26	.17	27	-.01	28	-.01	29	.06	30	.33
	31	.05	32	.01	33	.16	34	.10	35	-.13	36	.15
	37	.17	38	.33	39	.34	40	.34	41	.06	42	1.00
43. attitudes towards peers as as rated by teachers	1	.50	2	.31	3	.27	4	.18	5	.38	6	.32
	7	.27	8	.22	9	.02	10	.31	11	.36	12	-.06
	13	.08	14	.15	15	.39	16	-.02	17	.00	18	-.08
	19	-.08	20	.00	21	-.01	22	.05	23	.07	24	-.04
	25	.07	26	.22	27	.20	28	-.02	29	.02	30	.27
	31	.06	32	.10	33	.16	34	.13	35	-.07	36	.15
	37	.04	38	.17	39	.13	40	.18	41	-.00	42	.55
	43	1.00										
44. ornaments	1	.13	2	-.07	3	.15	4	.20	5	.16	6	.35
	7	.12	8	.03	9	.04	10	.32	11	.07	12	.03
	13	.13	14	.45	15	.26	16	.18	17	-.14	18	.06
	19	.29	20	-.06	21	-.06	22	.12	23	.10	24	.43
	25	-.06	26	.31	27	.21	28	.16	29	.18	30	.23
	31	-.09	32	-.17	33	-.23	34	-.00	35	.00	36	-.03
	37	.15	38	.00	39	-.09	40	-.04	41	-.30	42	.00
	43	-.06	44	1.00								
45. wire bending	1	.15	2	-.05	3	.06	4	-.02	5	-.05	6	.03
	7	.20	8	.06	9	.21	10	.32	11	.03	12	.06
	13	.06	14	.30	15	.17	16	.17	17	-.06	18	-.11
	19	-.11	20	-.26	21	.03	22	.01	23	.00	24	.32
	25	-.04	26	.01	27	.20	28	-.18	29	-.05	30	.10
	31	.05	32	-.04	33	-.03	34	.02	35	-.04	36	.25
	37	.08	38	-.18	39	-.06	40	-.14	41	-.26	42	.11
	43	.04	44	.41	45	1.00						
46. attitudes towards other people	1	.08	2	.12	3	.27	4	-.02	5	.14	6	.03
	7	.04	8	.12	9	.16	10	.04	11	.14	12	.17
	13	-.10	14	-.01	15	.19	16	.14	17	.01	18	-.06
	19	.08	20	.01	21	-.00	22	.00	23	-.16	24	.09
	25	.09	26	.18	30	.02	28	-.08	29	.00	30	.06
	31	.05	32	.17	33	--.11	34	-.13	35	-.21	36	.29
	37	.11	38	.17	39	.29	40	.24	41	.20	42	.26
	43	.18	44	-.04	45	.02	46	1.00				
47. attitudes towards work	1	.79	2	.58	3	.34	4	.50	5	.64	6	.66
	7	.63	8	.46	9	.29	10	.44	11	.67	12	-.01
	13	.25	14	.37	15	.82	16	-.09	17	-.03	18	-.01
	19	.14	20	.08	21	-.05	22	.06	23	.13	24	.11
	25	.10	26	.22	27	.16	28	.03	29	.19	30	.58
	31	-.06	32	-.14	33	.20	34	.10	35	-.14	36	.27
	37	.05	38	.17	39	.00	40	.02	41	-.25	42	.54
	43	.40	44	.11	45	.21	46	-.03	47	1.00		

(Table 27 continues)

48. emotional balance	1	.46	2	.22	3	.21	4	.23	5	.41	6	.26
	7	.21	8	.22	9	.10	10	.15	11	.33	12	.12
	13	.06	14	.26	15	.41	16	-.01	17	.04	18	-.09
	19	-.05	20	.08	21	-.04	22	.02	23	-.07	24	.04
	25	.27	26	.23	27	.12	28	.04	29	.08	30	.18
	31	.14	32	.07	33	.20	34	-.02	35	-.18	36	.20
	37	-.07	38	.29	39	.13	40	.33	41	-.03	42	.54
	43	.58	44	-.06	45	.04	46	.35	47	.41	48	1.00
49. activity	1	.34	2	.26	3	.16	4	.26	5	.40	6	.36
	7	.30	8	.38	9	.37	10	.23	11	.42	12	.11
	13	.12	14	.16	15	.49	16	.02	17	-.01	18	.02
	19	.11	20	.16	21	.01	22	.02	23	-.02	24	-.12
	25	-.03	26	.12	27	.07	28	.00	29	.20	30	.44
	31	.07	32	.05	33	.02	34	.01	35	-.14	36	.24
	37	.11	38	.15	39	.10	40	.17	41	.03	42	.34
	43	.23	44	-.08	45	-.05	46	.40	47	.44	48	.32
	49	1.00										
50. leadership	1	.25	2	.15	3	.36	4	.36	5	.27	6	.24
	7	.30	8	.08	9	.28	10	.16	11	.13	12	.01
	13	.06	14	.23	15	.28	16	.08	17	.24	18	.13
	19	.08	20	.11	21	.01	22	.26	23	.37	24	.15
	25	.18	26	.25	27	.23	28	.18	29	.25	30	.36
	31	.00	32	-.04	33	-.06	34	.13	35	-.10	36	.31
	37	.00	38	-.12	39	-.04	40	-.10	41	-.26	42	.21
	43	.27	44	.29	45	.28	46	.18	47	.26	48	.22
	49	.13	50	1.00								
51. companionship	1	.33	2	.27	3	.38	4	.33	5	.39	6	.38
	7	.33	8	.09	9	.16	10	.01	11	.36	12	.06
	13	.12	14	.17	15	.39	16	-.01	17	.20	18	.18
	19	.11	20	.10	21	.07	22	.22	23	.09	24	.05
	25	.23	26	.29	27	.16	28	.15	29	.19	30	.51
	31	-.09	32	-.06	33	.14	34	.10	35	-.14	36	.18
	37	-.01	38	.03	39	.16	40	.02	41	-.20	42	.32
	43	.43	44	.05	45	.05	46	.38	47	.30	48	.36
	49	.21	50	.53	51	1.00						
52. social status	1	.07	2	.12	3	-.00	4	.12	5	.10	6	-.00
	7	-.04	8	.15	9	-.13	10	-.06	11	.00	12	-.03
	13	-.08	14	.03	15	.00	16	.05	17	.18	18	.03
	19	.09	20	.03	21	.01	22	.15	23	.20	24	-.21
	25	-.01	26	.02	27	.00	28	-.05	29	-.08	30	.08
	31	-.02	32	-.08	33	-.05	34	.12	35	.15	36	.07
	37	-.04	38	.19	39	.14	40	.24	41	.01	42	.09
	43	.16	44	-.21	45	-.15	46	.03	47	.05	48	.02
	49	.06	50	-.03	51	-.10	52	1.00				
53. number of siblings	1	-.11	2	-.11	3	-.12	4	.09	5	-.19	6	-.25
	7	-.05	8	.20	9	.29	10	-.00	11	-.08	12	.16
	13	.16	14	.17	15	-.09	16	.03	17	.06	18	-.15
	19	.06	20	-.12	21	.10	22	-.09	23	.00	24	-.12
	25	-.06	26	-.00	27	-.07	28	-.13	29	-.02	30	-.06
	31	-.04	32	-.02	33	-.11	34	-.06	35	-.13	36	.12
	37	.10	38	-.09	39	-.08	40	-.18	41	-.07	42	-.08
	43	-.25	44	-.00	45	.09	46	.03	47	-.09	48	-.30
	49	.01	50	.01	51	-.12	52	.03	53	1.00		

Level of significance for two-tailed test:	.05	.01
	.23	.30

Table 28. Correlationmatrix, all variables included in the study. Girls + Boys, N = 155

1. carefulness	1	1.00										
2. religion	1	.55	2	1.00								
3. reading and literature	1	.42	2	.50	3	1.00						
4. composition	1	.40	2	.42	3	.56	4	1.00				
5. civics	1	.63	2	.65	3	.51	4	.53	5	1.00		
6. mathematics	1	.63	2	.45	3	.42	4	.43	5	.66		
7. book-keeping	1	.61	2	.47	3	.29	4	.35	5	.46	6	.59
	7	1.00										
8. home economics	1	.41	2	.26	3	.16	4	.16	5	.34	6	.28
	7	.24	8	1.00								
9. physical education	1	.22	2	.23	3	.29	4	.22	5	.12	6	.13
	7	.26	8	.13	9	1.00						
10. handcrafts	1	.48	2	.29	3	.33	4	.32	5	.39	6	.36
	7	.33	8	.29	9	.19	10	1.00				
11. vocational guidance	1	.60	2	.58	3	.46	4	.40	5	.68	6	.60
	7	.62	8	.34	9	.14	10	.40	11	1.00		
12. music	1	.01	2	.10	3	.13	4	.25	5	.08	6	-.04
	7	-.09	8	.02	9	.22	10	-.03	11	-.02	12	1.00
13. penmanship	1	.22	2	.25	3	.23	4	.41	5	.18	6	.10
	7	.08	8	.04	9	.31	10	.20	11	.10	12	.28
	13	1.00										
14. drawing	1	.24	2	.20	3	.18	4	.23	5	.25	6	.19
	7	.16	8	.23	9	.22	10	.26	11	.18	12	.17
	13	.27	14	1.00								
15. mean	1	.77	2	.66	3	.57	4	.53	5	.77	6	.72
	7	.72	8	.48	9	.34	10	.52	11	.77	12	.02
	13	.23	14	.31	15	1.00						
16. opposites	1	.04	2	.11	3	.41	4	.37	5	.13	6	.15
	7	.11	8	-.02	9	.31	10	.11	11	.06	12	.19
	13	.18	14	.04	15	.18	16	1.00				
17. synonyms	1	.09	1	.17	3	.37	4	.43	5	.18	6	.16
	7	.19	8	-.11	9	.24	10	.07	11	.13	12	.14
	13	.10	14	-.04	15	.21	16	.62	17	1.00		
18. word analogies	1	.06	2	.10	3	.30	4	.29	5	.17	6	.17
	7	.09	8	-.01	9	-.08	10	.10	11	.13	12	-.06
	13	.07	14	-.02	15	.17	16	.39	17	.43	18	1.00
19. mathemathical problems	1	.00	2	.11	3	.22	4	.16	5	.12	6	.42
	7	.24	8	.01	9	.14	10	.00	11	.22	12	-.01
	13	-.06	14	.01	15	.20	16	.30	17	.30	18	.21
	19	1.00										
20. additions	1	.18	2	.12	3	.30	4	.20	5	.14	6	.33
	7	.28	8	.02	9	.14	10	.00	11	.17	12	-.06
	13	.09	14	-.05	15	.22	16	.35	17	.35	18	.24
	19	.45	20	1.00								
21. number cancelling	1	.06	2	.17	3	.15	4	.17	5	.15	6	.17
	7	.15	8	.05	9	.20	10	.21	11	.15	12	.02
	13	.10	14	.07	15	.18	16	.23	17	.18	18	.15
	19	.06	20	.28	21	1.00						

(Table 28 continues)

22. V_1/K	1	.10	2	.23	3	.38	4	.38	5	.30	6	.27
	7	.11	8	.06	9	.01	10	.10	11	.13	12	.13
	13	.07	14	.07	15	.25	16	.41	17	.52	18	.40
	19	.32	20	.14	21	.05	22	1.00				
23. V_3/K	1	.14	2	.24	3	.35	4	.39	5	.28	6	.24
	7	.11	8	.02	9	.07	10	.17	11	.12	12	.05
	13	.00	14	.08	15	.23	16	.38	17	.53	18	.35
	19	.30	20	.13	21	-.03	22	.60	23	1.00		
24. S_2/K	1	.10	2	-.00	3	.16	4	.06	5	.20	6	.25
	7	.26	8	.14	9	-.08	10	.29	11	.20	12	-.02
	13	-.11	14	.20	15	.22	16	.13	17	.07	18	.14
	19	.27	20	.11	21	-.00	22	.15	23	.12	24	1.00
25. S_6/K	1	-.00	2	.00	3	.07	4	.10	5	.05	6	.18
	7	.20	8	-.02	9	-.09	10	.01	11	.02	12	-.06
	13	-.10	14	.12	15	.07	16	.09	17	.25	18	.31
	19	.30	20	.22	21	.11	22	.29	23	.15	24	.38
	25	1.00										
26. R_2/K	1	.09	2	.05	3	.20	4	.22	5	.22	6	.38
	7	.26	8	.14	9	.06	10	.19	11	.21	12	-.01
	13	.03	14	.06	15	.28	16	.19	17	.25	18	.29
	19	.42	20	.33	21	.18	22	.28	23	.17	24	.37
	25	.34	26	1.00								
27. R_3/OK	1	.05	2	.10	3	.19	4	.26	5	.12	6	.25
	7	.20	8	-.01	9	.11	10	.20	11	.10	12	.07
	13	.05	14	.20	15	.18	16	.18	17	.23	18	.29
	19	.24	20	.14	21	-.00	22	.28	23	.32	24	.22
	25	.23	26	.43	27	1.00						
28. N_1/K	1	.23	2	.14	3	.31	4	.24	5	.20	6	.42
	7	.22	8	.05	9	.14	10	.12	11	.18	12	-.10
	13	.12	14	-.03	15	.23	16	.33	17	.30	18	.28
	19	.39	20	.67	21	.29	22	.19	23	.09	24	.12
	25	.25	26	.29	27	.04	28	1.00				
29. N_2/K	1	.21	2	.16	3	.27	4	.30	5	.27	6	.43
	7	.22	8	.01	9	.13	10	.03	11	.23	12	-.02
	13	.13	14	-.05	15	.26	16	.24	17	.25	18	.32
	19	.23	20	.45	21	.28	22	.21	23	.17	24	.07
	25	.23	26	.28	27	-.01	28	.59	29	1.00		
30. general intelligence level as rated by teachers	1	.45	2	.41	3	.39	4	.57	5	.60	6	.60
	7	.49	8	.28	9	.16	10	.31	11	.52	12	.07
	13	.14	14	.18	15	.65	16	.20	17	.27	18	.21
	19	.20	20	.12	21	.13	22	.28	23	.30	24	.18
	25	.10	26	.27	27	.23	28	.09	29	.22	30	1.00
31. Sibelius	1	.02	2	.02	3	.00	4	.01	5	-.01	6	-.07
	7	-.03	8	-.01	9	.04	10	-.11	11	.02	12	.14
	13	.03	14	-.07	15	.01	16	.12	17	.10	18	.02
	19	.02	20	.11	21	.01	22	-.00	23	.09	24	-.01
	25	.07	26	-.00	27	-.04	28	.07	29	.10	30	-.03
32. gipsies	1	.02	2	-.05	3	.08	4	-.00	5	.07	6	-.05
	7	-.09	8	-.01	9	-.04	10	.00	11	.06	12	-.03
	13	-.08	14	-.07	15	-.01	16	-.02	17	-.00	18	.01
	19	-.14	20	-.05	21	.09	22	-.05	23	-.11	24	-.01
	25	.07	26	-.08	27	-.13	28	.00	29	.13	30	.01
	31	.14	32	1.00								

(Table 28 continues)

33. shift work	1	.17	2	.16	3	.21	4	.14	5	.13	6	.04
	7	.09	8	.04	9	.04	10	-.04	11	.14	12	.01
	13	-.02	14	-.04	15	.19	16	.02	17	.15	18	.11
	19	-.06	20	.09	21	.00	22	.11	23	.11	24	-.19
	25	-.03	26	-.07	27	-.11	28	.07	29	.07	30	.08
	31	.11	32	.01	33	1.00						
34. picture	1	.10	2	.08	3	.01	4	.12	5	.04	6	.12
	7	.16	8	.14	9	.09	10	-.06	11	.00	12	-.04
	13	.06	14	.02	15	.11	16	.08	17	.07	18	.03
	19	-.01	20	.05	21	.04	22	.15	23	.04	24	-.00
	25	.01	26	.03	27	.04	28	.11	29	.19	30	.06
	31	.08	32	.05	33	.07	34	1.00				
35. object	1	.03	2	.12	3	.10	4	.16	5	.13	6	.05
	7	.10	8	-.02	9	.01	10	.04	11	.05	12	.08
	13	.05	14	.00	15	.06	16	.19	17	.18	18	.13
	19	-.00	20	-.01	21	.15	22	.17	23	.09	24	-.02
	25	-.10	26	.02	27	-.00	28	.03	29	.10	30	.11
	31	.02	32	.21	33	.06	34	.54	35	1.00		
36. attitudes towards peers	1	.01	2	.01	3	.09	4	.11	5	.13	6	.07
	7	.00	8	.05	9	.04	10	.07	11	.02	12	.02
	13	.03	14	.09	15	.11	16	.10	17	.07	18	.11
	19	.11	20	.01	21	.17	22	.03	23	.04	24	.16
	25	.13	26	.07	27	.04	28	.00	29	.06	30	.17
	31	.08	32	.24	33	-.02	34	.09	35	.09	36	1.00
37. attitudes towards teachers	1	.11	2	-.01	3	.02	4	.03	5	.00	6	.01
	7	.11	8	.04	9	.11	10	.14	11	.07	12	-.08
	13	.07	14	.08	15	.05	16	.02	17	-.02	18	-.05
	19	-.00	20	-.03	21	.04	22	-.02	23	-.05	24	.07
	25	-.14	26	.04	27	.08	28	-.06	29	-.02	30	.00
	31	-.10	32	.20	33	-.11	34	.23	35	.30	36	.10
	37	1.00										
38. attitudes towards parents	1	.17	2	.08	3	.08	4	.14	5	.21	6	.22
	7	.09	8	-.05	9	.04	10	.03	11	.15	12	.04
	13	.10	14	.07	15	.15	16	.10	17	.09	18	-.03
	19	.10	20	.13	21	.05	22	.02	23	.05	24	.11
	25	-.04	26	.12	27	.06	28	.04	29	.08	30	.12
	31	.05	32	.14	33	-.03	34	.13	35	.18	36	.30
	37	.44	38	1.00								
39. attitudes towards mother	1	.17	2	.10	3	.10	4	.04	5	.14	6	.11
	7	.05	8	-.04	9	-.00	10	.04	11	.08	12	.00
	13	.06	14	.01	15	.07	16	.00	17	.09	18	.06
	19	.11	20	.09	21	.04	22	.01	23	.06	24	.01
	25	-.06	26	-.03	27	.05	28	.10	29	.10	30	.02
	31	.01	32	.12	33	-.11	34	.12	35	.10	36	.35
	37	.29	38	.54	39	1.00						
40. attitudes towards father	1	.20	2	.05	3	.12	4	.01	5	.11	6	.17
	7	.00	8	.02	9	-.04	10	.05	11	.12	12	-.03
	13	-.00	14	.07	15	.04	16	.05	17	.02	18	.01
	19	.12	20	.10	21	-.01	22	-.05	23	.04	24	.07
	25	.02	26	.01	27	.06	28	.14	29	.13	30	-.00
	31	.05	32	.24	33	-.01	34	.07	35	.12	36	.26
	37	.26	38	.52	39	.68	40	1.00				

(Table 28 continues)

41. attitude change as rated by teachers	1	.07	2	.02	3	-.02	4	-.14	5	-.01	6	-.07
	7	-.03	8	.15	9	-.10	10	.01	11	.10	12	-.13
	13	-.14	14	-.07	15	.01	16	-.15	17	-.12	18	-.08
	19	-.10	20	-.04	21	-.06	22	-.15	23	-.20	24	.00
	25	-.03	26	-.05	27	-.05	28	-.03	29	-.13	30	-.08
	31	.08	32	.04	33	.07	34	-.02	35	-.03	36	-.01
	37	-.00	38	.13	39	.08	40	.17	41	1.00		
42. attitudes towards teachers as rated by teachers	1	.55	2	.28	3	.15	4	.11	5	.40	6	.35
	7	.37	8	.34	9	.14	10	.27	11	.42	12	.02
	13	.00	14	.24	15	.43	16	-.11	17	-.07	18	-.14
	19	.04	20	.03	21	.03	22	-.09	23	-.07	24	.10
	25	.02	26	.09	27	.01	28	.09	29	.04	30	.16
	31	.04	32	-.00	33	.05	34	.08	35	-.08	36	.07
	37	.13	38	.24	39	.30	40	.29	41	.32	42	1.00
43. attitudes towards peers as rated by teachers	1	.48	2	.31	3	.16	4	.12	5	.40	6	.32
	7	.29	8	.20	9	.07	10	.26	11	.34	12	-.01
	13	.00	14	.13	15	.37	16	-.03	17	.02	18	-.12
	19	-.01	20	.01	21	.02	22	.01	23	.06	25	.01
	26	.14	27	.09	28	.04	29	-.04	30	.18	31	.07
	32	-.04	33	.09	34	.04	35	-.05	36	.02	37	.04
	38	.13	39	.04	40	.08	41	.26	42	.60	43	1.00
44. ornaments	1	.11	2	.00	3	.18	4	.12	5	.16	6	.29
	7	.24	8	.07	9	.06	10	.25	11	.18	12	-.04
	13	.04	14	.40	15	.27	16	.14	17	-.01	18	.14
	19	.30	20	.05	21	-.11	22	.19	23	.23	24	.45
	25	.17	26	.33	27	.30	28	.14	29	.08	30	.18
	31	-.02	32	-.15	33	-.15	34	.00	35	-.02	36	-.11
	37	.00	38	-.10	39	-.09	40	-.03	41	-.14	42	.02
	43	-.03	44	1.00								
45. wire bending	1	.10	2	-.03	3	.04	4	-.03	5	-.06	6	.06
	7	.18	8	.03	9	.22	10	.22	11	.04	12	.01
	13	.08	14	.35	15	.12	16	.06	17	-.03	18	-.09
	19	.04	20	-.03	21	-.09	22	.01	23	.04	24	.32
	25	.08	26	.09	27	.20	28	-.08	29	-.12	30	.06
	31	.02	32	-.15	33	-.11	43	-.03	35	-.16	36	.05
	37	-.05	38	-.11	39	-.12	40	-.13	41	-.17	42	.03
	42	-.00	44	.47	45	1.00						
46. attitudes towards other people	1	-.09	2	.03	3	.19	4	.04	5	.00	6	-.01
	7	.02	8	.02	9	.16	10	-.11	11	.00	12	.16
	13	.00	14	.04	15	.08	16	.17	17	.07	18	.09
	19	.10	20	.05	21	.06	22	.00	23	.01	24	.08
	25	.09	26	.14	27	.13	28	-.01	29	.06	30	.12
	31	.04	32	.09	33	-.03	34	-.02	35	-.08	36	.20
	37	.01	38	.05	39	.16	40	.12	41	-.04	42	-.00
	43	-.06	44	-.01	45	.07	46	1.00				
47. attitudes towards work	1	.71	2	.47	3	.29	4	.43	5	.59	6	.57
	7	.58	8	.39	9	.13	10	.43	11	.59	12	-.05
	13	.21	14	.26	15	.71	16	-.00	17	.07	18	.09
	19	.00	20	.09	21	-.03	22	.02	23	.11	24	.18
	25	.02	26	.15	27	.10	28	.09	29	.19	30	.54
	31	-.00	32	.00	33	.11	34	.04	35	-.02	36	.11
	37	.07	38	.15	39	.03	40	.06	41	-.04	42	.43
	43	.35	44	.13	45	.14	46	-.07	47	1.00		

(Table 28 continues)

48. emotional balance	1	.49	2	.23	3	.23	4	.20	5	.41	6	.31
	7	.36	8	.23	9	.09	10	.25	11	.41	12	.05
	13	.08	14	.21	15	.46	16	.06	17	.14	18	-.00
	19	-.05	20	.09	21	-.01	22	.00	23	.01	24	.14
	25	.11	26	.12	27	.09	28	.10	29	.10	30	.21
	31	.09	32	.07	33	.11	34	.04	35	-.01	36	.07
	37	-.02	38	.18	39	.12	40	.19	41	.12	42	.48
	43	.46	44	.01	45	-.00	46	.14	47	.53	48	1.00
49. activity	1	.17	2	.15	3	.23	4	.27	5	.27	6	.24
	7	.24	8	.23	9	.23	10	.11	11	.27	12	.12
	13	.11	14	.13	15	.38	16	.15	17	.15	18	.20
	19	.13	20	.15	21	.05	22	.06	23	.13	24	.03
	25	..03	26	.22	27	.22	28	.08	29	.14	30	.39
	31	.07	32	.06	33	.05	34	-.05	35	-.07	36	.10
	37	-.02	38	.04	39	.07	40	.10	41	-.05	42	.14
	43	.04	44	.03	45	.01	46	.56	47	.34	48	.28
	49	1.00										
50. leadership	1	.10	2	.11	3	.30	4	.34	5	.23	6	.15
	7	.12	8	.10	9	.23	10	.16	11	.12	12	.06
	13	.00	14	.17	15	.22	16	.11	17	.16	18	.07
	19	.04	20	.02	21	.05	22	.26	23	.31	24	.17
	25	.12	26	.20	27	.19	28	.05	29	.09	30	.34
	31	-.04	32	-.01	33	-.04	34	-.00	35	-.12	36	.19
	37	-.04	38	-.10	39	-.06	40	-.11	41	-.10	42	.09
	43	.14	44	.21	45	.19	46	.25	47	.14	48	.08
	49	.21	50	1.00								
51. companionship	1	.21	2	.19	3	.28	4	.27	5	.25	6	.24
	7	.24	8	.12	9	.15	10	.06	11	.27	12	.05
	13	.00	14	.09	15	.30	16	.04	17	.18	18	.13
	19	.10	20	.08	21	.09	22	.19	23	.15	24	.11
	25	.16	26	.22	27	.18	28	.07	29	.11	30	.40
	31	-.04	32	-.01	33	.14	34	.08	35	-.05	36	.12
	37	.02	38	.02	39	.07	40	.04	41	-.12	42	.20
	43	.27	44	.09	45	.03	46	.32	47	.21	48	.19
	49	.24	50	.48	51	1.00						
52. social status	1	-.09	2	-.14	3	-.11	4	-.00	5	-.14	6	-.20
	7	-.15	8	-.05	9	-.05	10	-.09	11	-.16	12	-.03
	13	-.02	14	.05	15	-.20	16	.01	17	.03	18	-.09
	19	-.08	20	.07	21	-.09	22	-.08	23	.01	24	-.12
	25	-.11	26	-.08	27	-.01	28	-.07	29	-.03	30	-.00
	31	.03	32	.02	33	-.03	34	.05	35	.05	36	.06
	37	..02	38	.09	39	.08	40	.15	41	-.06	42	-.03
	43	-.09	44	-.12	45	-.06	46	.10	47	.08	48	.04
	49	.07	50	-.07	51	-.10	52	1.00				
53. number of siblings	1	-.16	2	-.08	3	-.14	4	-.04	5	-.17	.6	-.17
	7	-.09	8	.03	9	.16	10	-.04	11	-.11	12	.07
	13	.06	14	.11	15	-.11	16	-.07	17	.01	18	-.14
	19	.04	20	-.10	21	.04	22	-.12	23	-.14	24	-.06
	25	.00	26	.02	27	-.10	28	-.09	29	-.07	30	-.12
	31	-.00	32	-.00	33	-.10	34	.01	35	-.03	36	-.11
	37	.08	38	-.06	39	-.09	40	-.14	41	-.04	42	-.10
	43	-.16	44	.01	45	.05	46	-.02	47	-.09	48	-.20
	49	-.04	50	-.01	51	-.14	52	.09	53	1.00		

Level of significance for two-tailed test:	.05	.01
	.19	.25

Inspection of the correlation matrices in Tables 26 to 28 reveal that significant correlations between school achievement and intelligence variables were obtained for each subject group. Because of the large number of such correlations, they will not be considered separately. The correlations will be discussed in Part IV.. To facilitate the interpretation of interrelations, factor analyses were performed. Factor analyses were performed for each subject group by employing principal factor factorization and varimax rotation. The results are presented in Tables 29 to 34.

Table 29. Unrotated factor matrix, school marks and intelligence.

Girls, N = 87

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1. opposites	-.62	.43	.19	-.16	.27	-.04	-.01	.06	-.18	.07	.02
2. synonyms	-.65	.35	-.03	-.13	.24	-.10	-.09	.02	-.08	.13	-.05
3. word analogies	-.46	.33	-.15	.20	.08	.11	.18	.06	-.11	-.19	.05
4. mathemathical problems	-.40	.50	-.13	.11	.07	-.24	-.18	-.07	.17	.00	-.04
5. additions	-.50	.41	.47	-.11	-.09	-.16	-.03	.04	.11	-.02	.14
6. number cancelling	-.26	.08	.42	.03	-.19	.04	-.03	.28	-.20	.02	-.14
7. V_1/K	-.54	.33	-.27	-.00	.20	.02	.21	-.17	-.04	-.03	-.12
8. V_3/K	-.52	.20	-.39	-.14	.20	-.09	.15	-.06	-.16	.01	.20
9. S_2/K	-.44	.15	-.41	.01	-.37	-.04	-.04	.06	.02	.03	.04
10. S_6/K	-.26	.35	-.23	.09	-.43	.23	-.01	-.15	-.14	-.02	-.07
11. R_2/K	-.34	.30	-.21	.18	-.16	-.05	.10	.18	.16	-.02	-.19
12. R_3/OK	-.30	.27	-.52	-.08	-.10	.00	-.09	.05	.16	-.07	.05
13. N_1/K	-.55	.37	.52	.09	-.08	.05	-.02	-.09	.13	-.04	-.01
14. N_2/K	-.44	.25	.37	.34	-.12	.34	.11	-.06	-.06	.06	.06
15. general intelligence level as rated by teachers	-.59	-.30	-.21	-.01	.14	.17	-.09	.18	.00	.27	.07
16. carefulness	-.70	-.43	.20	-.12	-.06	-.02	.19	-.10	.14	-.01	.17
17. religion	-.67	-.34	.08	-.09	.04	-.10	-.16	-.12	-.11	-.31	-.11
18. reading (and literature)	-.79	.08	.07	-.03	.22	.11	-.10	.06	.11	-.13	.05
19. composition	-.63	-.18	-.16	-.09	.22	.42	-.09	.11	.05	.01	-.04
20. civics	-.80	-.36	-.06	.15	-.01	-.09	-.01	-.16	-.12	-.08	-.03
21. mathematics	-.78	-.11	.04	.27	-.12	.01	-.00	-.15	.14	.17	.06
22. book-keeping	-.76	-.28	-.01	.11	-.20	-.09	-.17	-.11	-.02	.19	-.03
23. home economics	-.36	-.25	.06	.04	.02	-.15	.48	.06	.01	.08	-.12
24. physical education	-.33	.18	.25	-.57	-.07	-.08	-.00	-.01	-.02	.10	-.11
25. handcrafts	-.54	-.16	-.07	-.17	-.26	-.08	.14	.27	.09	-.15	.11
26. vocational guidance	-.74	-.33	-.04	.22	.04	-.09	-.16	.14	-.05	-.10	-.05
27. music	.08	.01	-.16	-.29	.07	.12	.07	-.07	.20	.06	-.19
28. penmanship	-.19	-.11	.17	-.36	.04	.25	.01	-.08	.15	-.14	-.02
29. drawing	-.19	-.02	-.14	-.54	-.36	.06	-.02	-.07	-.17	.02	.05
30. mean	-.90	-.31	-.01	-.03	.02	-.07	.04	-.03	-.00	.05	-.11

eigenvalues	9,105	2,477	1,928	1,341	1,034	0,663 0,433	0,573 0,402	0,449 0,298
product of eigenvalues	9,105	22,553	43,482	58,309	60,292	39,974 4,453	22,905 1,790	10,284 0,533
eigenvalues as a percentage of the number of variables	30,33	8,23	6,43	4,47	3,43	2,20 1,43	1,90 1,33	1,43 0,97

Table 30. Rotated factor matrix, school marks and intelligence.

Girls, N = 87

		I	II	III	IV	V	VI	h^2
1.	opposites	.18	.69	.40	-.18	.03	.07	.70
2.	synonyms	.27	.69	.20	-.14	-.09	.04	.62
3.	word analogies	.13	.46	.17	.14	-.30	.19	.40
4.	mathemathical problems	.04	.60	.17	.11	-.26	-.17	.50
5.	additions	.14	.38	.67	-.21	-.01	-.19	.69
6.	number cancelling	.15	-.04	.52	-.08	-.01	-.02	.30
7.	V_1/K	.20	.62	.02	-.02	-.25	.15	.51
8.	V_3/K	.27	.60	-.17	-.12	-.22	.06	.53
9.	S_2/K	.27	.20	-.04	-.09	-.63	-.07	.52
10.	S_6/K	-.04	.09	.19	-.05	-.66	.11	.49
11.	R_2/K	.10	.30	.11	.12	-.43	-.04	.31
12.	R_3/OK	.06	.38	-.21	-.10	-.50	.03	.45
13.	N1/K	.18	.31	.77	-.05	-.05	.02	.73
14.	N2/K	.15	.11	.67	.18	-.18	.31	.64
15.	general intelligence level as rated by teachers	.60	.19	-.11	-.06	-.09	.33	.53
16.	carefulness	.79	.01	.22	-.23	.05	.08	.73
17.	religion	.73	.15	.11	-.15	.05	.04	.59
18.	reading (and literature)	.51	.51	.29	-.10	-.04	.27	.69
19.	composition	.50	.28	-.01	-.16	-.08	.57	.69
20.	civics	.86	.18	.09	.05	-.13	.07	.80
21.	mathematics	.68	.21	.32	.13	-.26	.10	.70
22.	book-keeping	.77	.10	.19	-.03	-.25	-.00	.71
23.	home economics	.46	.05	.05	.02	.05	-.07	.22
24.	physical education	.10	.24	.28	-.61	.06	-.12	.54
25.	handcrafts	.52	.07	.09	-.28	-.26	-.07	.43
26.	vocational guidance	.80	.19	.10	.14	-.09	.07	.72
27.	music	-.12	.04	-.20	-.26	.01	.12	.14
28.	penmanship	.13	-.01	.12	-.40	.12	.25	.27
29.	drawing	.11	-.05	-.05	-.62	-.29	-.04	.49
30.	mean	.89	.28	.14	-.13	-.09	.10	.92

Table 31. Unrotated factor matrix, school marks and intelligence. Boys, N = 70

	I	II	III	IV	V	VI	VII	VIII	IX	X
1. opposites	-.18	-.51	.37	-.05	.32	-.06	.01	-.32	.03	-.07
2. synonyms	-.22	-.71	.34	.09	-.01	.10	.13	-.11	-.10	.03
3. word analogies	-.21	-.56	-.03	.13	.03	.25	-.06	.17	-.25	-.04
4. mathemathical problems	-.46	-.41	-.21	-.03	-.03	-.30	.02	-.07	.21	-.04
5. additions	-.44	-.52	-.24	-.39	-.10	.05	-.05	-.04	-.09	-.07
6. number cancelling	-.28	-.20	-.06	-.21	.17	-.02	.07	.21	.12	-.27
7. V1/K	-.32	-.51	.22	.47	-.08	-.08	-.06	.07	.05	-.02
8. V_3/K	-.29	-.49	.27	.37	-.21	.09	-.13	-.10	.27	.08
9. S_2/K	-.18	-.06	-.39	.22	.35	-.28	-.08	-.19	-.03	-.07
10. S_6/K	-.24	-.45	-.29	.26	.10	-.13	.10	.03	-.28	.11
11. R2/K	-.57	-.36	-.30	-.01	.29	-.04	.11	.11	.08	.02
12. R_3/OK	-.38	-.22	.09	.10	.35	.24	.14	.31	.17	.10
13. N_1/K	-.33	-.47	-.44	-.34	-.12	.01	-.31	-.02	-.02	.11
14. N_2/K	-.45	-.37	-.19	-.35	-.28	-.01	-.06	-.05	.10	.08
15. general intelligence level as rated by teachers	-.78	-.01	-.07	.17	-.10	-.00	.22	.07	.08	-.08
16. carefulness	-.67	.45	-.05	.10	-.15	.12	.03	-.13	-.12	.20
17. religion	-.59	.24	.25	.05	-.36	-.02	.03	.05	-.07	-.02
18. reading (and literature)	-.52	-.01	.35	.08	-.01	-.06	-.28	-.05	-.20	-.10
19. composition	-.74	-.22	.25	-.06	.02	.07	-.09	-.06	-.09	.12
20. civics	-.77	.25	-.03	.14	-.23	-.03	-.09	.07	.01	-.14
21. mathematics	-.80	.08	-.27	.02	-.09	.02	-.01	.10	.21	-.05
22. book-keeping	-.67	.20	-.07	-.04	.06	.16	.35	-.23	-.12	-.00
23. home economics	-.36	.44	-.12	.10	.14	-.25	-.05	-.01	-.05	.21
24. physical education	-.38	.13	.44	-.39	.12	.01	.16	-.03	.12	.01
25. woodwork	-.40	.26	-.16	.02	.48	.21	-.09	-.17	.08	-.01
26. metalwork	-.33	.40	.07	.04	.18	.29	-.35	-.08	.06	-.15
27. vocational guidance	-.72	.45	-.08	-.03	-.17	-.08	.08	.00	-.04	-.11
28. music	-.20	-.06	.45	-.20	.01	-.42	.06	-.01	-.01	-.04
29. penmanship	-.36	.03	.35	-.39	.18	.01	-.09	.16	-.01	.15
30. drawing	-.42	.28	.20	.07	.27	-.25	-.20	.24	-.05	.07
31. mean	-.85	.41	-.03	.03	.01	.05	.04	-.04	-.02	.01
eigenvalues	7,701	4,103	1,984	1,391	1,281	0,822	0,684	0,571	0,502	0,338
product of eigenvalues	7,701	31,597	62,688	87,199	111,702	91,819	62,804	35,861	18,002	6,085
eigenvalues as a percentage of the number of variables	24,84	13,23	6,39	4,48	4,13	2,65	2,19	1,84	1,61	1,10

Table 32. Rotated factor matrix, school marks and intelligence. Boys, N = 70

	I	II	III	IV	V	VI	h^2
1. opposites	-.22	.15	.47	-.45	.10	.17	.54
2. synonyms	-.16	.26	.73	-.22	-.08	.03	.68
3. word analogies	-.08	.32	.53	.11	-.01	.19	.44
4. mathemathical problems	.18	.50	.27	-.10	.36	-.13	.51
5. additions	.07	.80	.19	-.10	-.01	.05	.70
6. number cancelling	.04	.33	.05	-.19	.11	.17	.19
7. V_1/K	.11	.04	.77	-.03	.18	-.11	.65
8. V_3/K	.12	.07	.75	.00	-.06	-.10	.59
9. S2/K	.06	.09	-.01	.11	.63	.12	.44
10. S_6/K	.00	.30	.38	.17	.42	.01	.44
11. R_2/K	.21	.51	.25	-.06	.42	.30	.63
12. R_3/OK	.11	.12	.34	-.13	.11	.46	.38
13. N_1/K	.03	.80	.07	.08	.09	-.00	.66
14. N_2/K	.21	.70	.13	-.07	-.09	-.11	.58
15. general intelligence level as rated by teachers	.68	.25	.29	-.05	.17	.09	.66
16. carefulness	.82	.00	-.06	.00	-.03	.14	.70
17. religion	.69	-.00	.14	-.20	-.18	-.15	.60
18. reading (and literature)	.42	-.01	.31	-.36	.01	.04	.41
19. composition	.46	.32	.42	-.38	-.02	.19	.67
20. civics	.83	.12	.12	-.06	.07	-.00	.73
21. mathematics	.73	.38	.08	.02	.19	.14	.73
22. book-keeping	.61	.20	.01	-.10	.04	.31	.52
23. home economics	.47	-.13	-.24	-.10	.34	.05	.43
24. physical education	.24	.07	-.04	-.61	-.21	.17	.52
25. woodwork	.32	.01	-.13	-.05	.23	.59	.53
26. metalwork	.42	-.16	-.11	-.05	-.08	.41	.39
27. vocational guidance	.84	.10	-.16	-.13	.07	.01	.76
28. music	.07	.00	.09	-.62	.06	-.24	.46
29. penmanship	.17	.15	-.02	-.57	-.14	.21	.43
30. drawing	.39	-.18	-.02	-.38	.29	.12	.43
31. mean	.89	.09	-.04	-.17	.10	.25	.90

Table 33. Unrotated factor matrix, school marks and intelligence. Girls + Boys, N = 157

	I	II	III	IV	V	VI	VII	VIII	IX	X
1. opposites	-.42	-.50	.30	-.18	.07	.11	-.19	.00	.19	.05
2. synonyms	-.47	-.55	.29	-.04	-.11	.17	-.11	.12	.07	-.06
3. word analogies	-.38	-.44	.04	.12	-.14	-.22	-.12	.16	-.04	-.01
4. mathemathical problems	-.40	-.40	-.24	.11	.08	.26	.16	-.19	.03	.04
5. additions	-.45	-.41	-.35	-.38	.10	.15	-.04	-.06	-.09	.06
6. number cancelling	-.27	-.11	-.09	-.29	.11	-.14	-.09	.16	.20	-.04
7. V_1/K	-.47	-.42	.28	.27	-.17	-.06	.00	-.18	-.01	-.09
8. V_3/K	-.44	-.35	.34	.29	-.21	.09	-.08	-.14	-.15	.04
9. S_2/K	-.30	-.10	-.25	.40	.27	-.09	-.11	-.05	.12	-.09
10. S_6/K	-.25	-.37	-.26	.28	.13	-.14	.06	.05	.01	-.29
11. R_2/K	-.44	-.30	-.25	.22	.24	-.08	.10	.04	.04	.13
12. R_3/OK	-.33	-.23	.09	.35	.28	.05	.09	.14	-.22	.11
13. N_1/K	-.46	-.39	-.39	-.41	-.02	-.12	-.04	-.12	-.10	-.01
14. N_3/K	-.45	-.29	-.27	-.32	-.17	-.24	.15	.00	.01	-.02
15. general intelligence level as rated by teachers	-.68	.16	.09	.17	-.09	.00	.18	.15	.16	.20
16. carefulness	-.68	.47	-.06	-.09	-.08	-.00	-.13	-.04	-.21	-.03
17. religion	-.63	.32	.16	-.10	-.18	.08	.05	-.04	-.06	-.22
18. reading (and literature)	-.67	-.05	.21	-.10	-.06	-.02	-.10	-.08	-.01	-.01
19. composition	-.68	-.04	.34	-.06	-.02	-.14	.13	.11	-.02	.07
20. civics	-.76	.32	.05	.07	-.21	-.14	.07	-.07	.08	-.02
21. mathematics	-.78	.12	-.29	.06	-.06	.00	.18	-.07	-.06	.13
22. book-keeping	-.67	.24	-.26	.05	.05	.30	.01	.24	-.03	-.15
23. home economics	-.34	.37	-.07	.07	.12	-.09	-.13	-.30	.15	.09
24. physical education	-.33	.04	.21	-.35	.35	.24	p02	-.04	.01	-.01
25. handcrafts	-.49	.25	.02	.07	.24	-.15	-.37	.07	-.09	.12
26. vocational guidance	-.71	.38	-.15	.04	-.15	.10	-.02	.07	.14	-.02
27. music	-.09	-.01	.43	-.11	.19	-.03	.22	-.09	.12	-.04
28. penmanship	-.27	.09	.34	-.34	.22	-.19	.14	.06	-.14	-.00
29. drawing	-.29	.21	.19	.07	.43	-.10	.06	-.10	-.04	-.15
30. mean	-.86	.38	-.03	.02	.01	.07	-.05	.00	.04	-.00
eigenvalues	8,002	2,971	1,735	1,474	0,976	0,595	0,505	0,433	0,357	0,327
product of eigenvalues	8,002	23,774	41,248	60,800	59,341	35,308	17,831	7,721	2,756	0,901
eigenvalues as a percentage of the number of variables	26,67	9,90	5,77	4,90	3,27	2,00	1,67	1,43	1,20	1,10

Table 34. Rotated factor matrix, school marks and intelligence. Girls + Boys, N = 157

		I	II	III	IV	V	VI	h^2
1.	opposites	-.02	.31	.58	.07	.30	.21	.57
2.	synonyms	.03	.25	.72	.07	.12	.21	.65
3.	word analogies	.05	.27	.50	.24	-.04	-.18	.42
4.	mathemathical problems	.09	.29	.30	.38	-.14	.35	.46
5.	additions	.09	.70	.14	.17	.00	.34	.66
6.	number cancelling	.11	.40	.01	.04	.19	-.01	.21
7.	V_1/K	.14	.05	.70	.23	.03	-.08	.58
8.	V_3/K	.16	-.06	.72	.15	.01	.03	.57
9.	S_2/K	.17	.01	.03	.60	-.05	-.02	.40
10.	S_6/K	-.02	.21	.18	.52	-.13	-.05	.37
11.	R_2/K	.15	.26	.18	.58	.00	.05	.45
12.	R_3/OK	.09	-.08	.30	.49	.15	.11	.38
13.	N_1/K	.13	.80	.12	.13	-.04	.07	.70
14.	N_3/K	.19	.68	.19	.04	-.07	-.12	.56
15.	general intelligence level as rated by teachers	.64	.02	.30	.16	.08	-.01	.53
16.	carefulness	.81	.13	-.02	-.03	.12	.01	.70
17.	religion	.69	.06	.21	-.15	.15	.05	.57
18.	reading (and literature)	.47	.23	.42	.03	.26	.03	.52
19.	composition	.46	.17	.47	.04	.36	-.09	.60
20.	civics	.81	.10	.23	.04	.07	-.17	.76
21.	mathematics	.71	.31	.13	.28	-.08	.06	.71
22.	book-keeping	.69	.14	.01	.22	-.04	.35	.66
23.	home economics	.47	-.03	-.16	.14	.13	-.06	.29
24.	physical education	.18	.17	.04	-.05	.50	.37	.46
25.	handcrafts	.49	.04	-.03	.25	.29	-.07	.39
26.	vocational guidance	.82	.11	.06	.06	-.05	.09	.70
27.	music	-.02	-.09	.17	-.08	.44	.01	.24
28.	penmanship	.16	.16	.06	-.13	.57	-.08	.40
29.	drawing	.26	-.11	-.07	.25	.47	-.01	.37
30.	mean	.89	.12	.12	.14	.17	.10	.89

Since discovery of interrelations between school achievement and intelligence was the objective of these analyses, the number of factors was varied in rotation. In interpretation it will be used the number of factors, where interrelations can be seen. Where sufficiently strong associations are concerned, mixed school achievement - intelligence factors may emerge. Where the associations are weaker, interrelations between school achievement and intelligence are likely to be indicated either by loadings of intelligence variables on school achievement factors or by loadings of school achievement variables on intelligence factors.

A six-factor rotation will here be used in the interpretation of interrelations between school achievement and intelligence in the girl group. Factor III is spanned by four variables of numerical ability. The loading of arithmetic is .32, so that the factor accounts for 10 per cent of the variance of the marks in this school subject. Factor II is determined by verbal-ability variables. It explains 26 per cent of the variance of reading and literature and 9 per cent of that of composition.

The interpretations for the boy group will also be based on a six-factor rotation. Factor II is spanned mainly by numerical-ability variables and accounts for 11 per cent of the variance of arithmetic and 10 per cent of that of composition. Factor III is determined by verbal-ability variables and explains 18 per cent of the variance of composition and 10 per cent of that of reading and literature. Factor V is a visual-ability factor, and it explains 12 per cent of the variance of home economics. It should also be pointed out that the Opposites test obtains a loading .45 on the partial factor of practical subjects. Moreover, when use was made of a small number of factors, there is a tendency for the handcrafts and reasoning variables to obtain loadings on one and the same factor.

The following interpretations for the combined group of girls and boys is also based on a six-factor rotation. Factor II, a numerical factor, explains 10 per cent of the variance of arithmetic. Factor III, a verbal factor accounts for 18 per cent of the variance of reading and literature and for 22 per cent of that of composition. Moreover, the visualization and reasoning factor is found to contribute to the variances of arithmetic, book-keeping, handcrafts and drawing. Factor VI is spanned by physical education, book-keeping, mathematical problems and addition. This is a combined factor. The general intelligence level, as rated by teachers, also has in each subject group loadings on school achievement factors. This suggests the ratings given by the teachers are influenced by what they know of the pupils' school achievement.

The most distinct result yielded by the above analysis of interrelations between intelligence and school achievement is that verbal ability, as measured by the present test battery, is capable of explaining pupils' marks for reading and literature and composition and that numerical ability, similarly measured, contributes to their marks for arithmetic.

The analysis model chosen for the present study was not the one most suitable for use in the study of the interrelations concerned. Nevertheless, it made possible the presentation of the information contained in the correlations in a concise form; and, through varying the number of factors, interrelations between the two groups of variables were discovered. In continuation studies it might be appropriate to make use of another type of factor analytical design, say, a guided oblique rotation. Another possible approach would be the use of multiple regression models. In the present study, canonical analysis was employed in the further investigation of these interrelations.

5. Interrelations between School Achievement and the Explanatory Variables in the Light of Correlations, Factor Analyses and Coefficients of Congruence

The present chapter considers interrelations between school achievement and all the other variables included in this study and not only intelligence variables, as did the preceding chapter. The factor analysis model employed was intended to serve two purposes. First, the aim was to discover the nature of the dimensions spanned by the variables of this study. Secondly, it was used to obtain information about interrelations between school achievement and other variables.

The principal factor method was used in factoring and the varimax method in rotation. Rotations with seven, nine and eleven factors were performed for each group, with the object of finding a solution which would be as clear-cut as possible from the standpoint of interpretation. Moreover, it was considered desirable to find out how the configuration was affected by the number of dimensions. This can be studied by comparing the interpretations obtained for rotated matrices involving various numbers of dimensions. More accurate knowledge about this point is provided, however, by the factor correspondence coefficients (coefficients of congruence, Harman 1962, pp. 256-260).

The usefulness of these congruence coefficients is reduced by the fact, however, that their statistical significance is difficult to approach mathematically. Geometrically, they are cosines of angles between vectors. For purposes of computation, the vectors are transformed so as to be of unit length each. The differences between communalities have thus disappeared. The coefficient varies between +1 and -1. The value of the coefficient depends on the following: the number of common variables, the extent to which the groups are different, the difference between the numbers of factors to be compared and the proportion of the variance of the variables accounted for by the factors. Tucker has used .45 as the lower limit in factor identification. (Harman 1962, pp. 256-260). Pitkänen (1967) has made use of these coefficients and employed a higher limit in factor identification.

In the present study coefficients of congruence were used to compare factor analyses computed with varied numbers of factors for each particular subject group. This provided information on how the number of factors affected the configuration. Secondly, congruence coefficients were computed for every combination of subject group and number of factors, so as to obtain knowledge about the correspondence between factors for various groups. Finally, the congruence coefficients for the factors included in each particular matrix were evaluated, to obtain knowledge of the interrelations of factors and the degree of orthogonality of the respective configurations. Space does not permit presenting all the results of these calculations.

5.1. The Structure of the Research Battery

What was the nature of the dimensions spanned by the variables included in the study ? This was the first of the questions to which answers were sought through factor analysis. As was stated in the theoretical part (I) of this study and in the sections describing the variables, the present study was based on the assumption of the existence of the following dimensions: school achievement, intelligence, attitudes, attitude-dependent persuasibility, attitude-independent persuasibility, dexterity, a sociometric dimension, and a dimension representing the traits rated by teachers. All these dimensions were hypothesized to emerge here, except the last one, concerning which no hypothesis based on previous findings could be advanced.

Information of factor analyses is presented in Tables 35 to 37.

Table 35. Rotated factor matrix, all variables included in the study. Girls, N = 87

	h^2	1	2	3	4	5	6	7	8	9	10	11
1. opposites	.73	.26	.20	.05	.07	-.13	.51	-.02	-.02	-.16	-.09	-.56
2. synonyms	.66	.34	.30	.11	.02	-.08	.31	.08	.01	-.08	-.05	-.57
3. word analogies	.48	.23	.43	-.03	-.18	-.06	.21	.06	.04	-.25	-.23	-.20
4. mathemathical problems	.59	.02	.52	.23	-.09	-.02	.29	-.21	-.19	.09	-.10	-.27
5. additions	.66	.13	.13	.15	.14	.04	.70	.03	.06	.02	-.05	-.28
6. number cancelling	.42	.14	-.11	.01	-.04	-.17	.52	.05	-.10	.03	.26	.04
7. V_1/K	.60	.29	.47	-.05	.03	-.05	.11	.06	-.35	-.15	-.23	-.29
8. V_3/K	.58	.31	.43	.09	.11	-.15	-.06	-.07	-.13	-.08	-.33	-.34
9. S_2/K	.57	.27	.65	-.02	.14	-.08	-.00	.02	.11	.09	.18	.00
10. S_6/K	.45	.03	.57	-.04	.04	-.03	.22	.03	-.07	-.08	.14	.18
11. R_2/K	.36	.10	.50	-.09	-.10	-.18	.16	.11	-.04	.04	.06	-.07
12. R_3/OK	.51	.07	.60	.18	.12	-.23	-.14	-.01	.02	.03	-.11	-.10
13. N_1/K	.74	.21	.13	.02	.00	.07	.80	-.01	.00	.05	-.14	-.11
14. N_2/K	.63	.26	.14	.09	-.24	.03	.62	.13	.08	-.21	-.05	.17
15. general intelligence level as rated by teachers	.64	.69	.10	.05	.00	-.33	-.10	-.03	.06	-.11	.06	-.07
16. carefulness	.83	.76	-.09	.05	.18	.13	.20	.08	.10	.27	-.24	.01
17. religion	.63	.70	-.02	.11	.12	.01	.13	.09	-.21	.14	-.06	-.09
18. reading (and literature)	.69	.61	.20	.12	.02	-.13	.35	.00	-.12	-.13	-.11	-.27
19. composition	.60	.67	.09	.06	.10	-.26	.02	-.06	-.05	-.22	-.05	-.09
20. civics	.81	.84	.16	-.05	-.07	.01	.10	-.01	-.05	.23	-.03	-.10
21. mathematics	.75	.68	.30	.08	-.07	.04	.35	-.07	-.05	.15	-.12	.13
22. book-keeping	.71	.72	.24	-.01	.03	-.02	.20	.14	.14	.21	-.10	.03
23. home economics	.36	.38	-.02	-.31	.04	-.09	.10	.11	-.04	.19	-.24	.02
24. physical education	.59	.08	-.04	.16	.51	-.18	.38	.13	-.13	.14	.04	-.26
25. handcrafts	.45	.53	.20	-.01	.24	.08	.09	-.09	.02	.15	.12	-.05
26. vocational guidance	.76	.78	.16	.03	-.18	-.06	.09	.03	.04	.23	.02	-.13
27. music	.15	-.09	-.04	-.06	.26	-.18	-.12	-.12	-.01	-.05	-.04	-.07
28. penmanship	.32	.22	-.16	.09	.41	.06	.12	-.01	.08	-.21	-.07	.00
29. drawing	.53	.10	.21	.11	.64	-.05	-.02	.12	.08	.10	.14	.03
30. mean	.92	.88	.15	-.06	.09	-.11	.19	.08	-.00	.16	-.12	-.16
31. Sibelius, change score	.12	.05	-.04	.01	.00	-.01	.01	.16	.08	.02	-.02	-.29
32. Gipsies, change score	.33	.12	-.15	.28	-.24	-.06	.12	.22	.15	-.15	.21	.03
33. Shift work, change score	.31	.15	-.17	-.05	-.15	-.05	.04	.18	-.06	-.04	-.40	-.17
34. Total picture difference	.60	-.07	.06	.06	.11	.02	.09	.74	.01	.05	-.11	.00
35. Total object difference	.61	.12	.07	.13	-.11	.07	.06	.70	.04	-.08	.09	-.21
36. Attitudes towards peers	.40	-.09	.01	.60	-.02	-.07	.03	-.03	-.03	-.11	.10	-.11
37. Attitudes towards teachers	.62	.04	-.01	.50	-.10	.04	-.13	.54	-.03	.10	.17	-.07

(Table 35 continues)

	h^2	1	2	3	4	5	6	7	8	9	10	11
38. Attitudes towards parents	.57	.15	-.02	.66	.05	.03	.00	.22	-.02	.14	.15	-.10
39. Attitudes towards mother	.74	.04	-.05	.79	.10	.02	.12	.03	.05	.09	-.27	.05
40. Attitudes towards father	.68	.08	.03	.75	.03	.03	.18	.10	.09	.09	-.21	.08
41. Change in attitudes, as rated by teachers	.52	.23	-.01	.10	-.05	.06	-.11	.11	-.02	.65	.03	-.02
42. Attitudes towards teachers, as rated by teachers	.73	.22	.04	.15	-.00	.06	.10	-.03	.14	.77	-.08	.17
43. Attitudes towards peers as rated by teachers	.69	.28	-.05	-.08	.02	.06	-.01	-.06	-.06	.77	-.01	-.05
44. Ornaments	.54	.19	.63	-.16	.28	.02	-.04	.04	.03	-.01	-.04	.03
45. Wire bending	.50	.07	.32	-.10	.59	-.00	-.08	-.11	.01	-.07	.10	.07
46. Attitudes towards other people	.72	-.13	.09	.08	.12	-.71	.13	.02	.19	-.31	-.12	-.03
47. Attitudes towards work	.77	.68	.03	-.00	.00	.05	-.04	.04	.52	.14	.02	.05
48. Emotional balance	.67	.46	.04	-.03	.04	.05	.05	.07	.57	.33	-.07	-.08
49. Activity	.73	.16	.20	.00	.02	-.65	.11	-.11	.40	-.15	-.15	-.13
50. Leadership	.49	.15	.11	-.10	.09	-.58	-.08	-.19	-.23	-.00	-.11	-.02
51. Companionship	.37	.15	.14	.01	-.04	-.54	.01	.08	-.13	.09	-.06	-.00
52. Social status	.38	-.24	-.15	.15	.09	.01	-.06	.05	.45	-.20	.09	-.13
53. The number of siblings	.15	-.14	-.03	-.07	.07	.10	-.02	.13	-.02	-.05	.31	-.01
Variances of factors	29.97	7.76	3.48	2.79	1.83	2.10	3.14	1.83	1.49	2.70	1.21	1.63
as percentages of number of variables	56.54	14.65	6.56	5.26	3.46	3.95	5.92	3.46	2.82	5.10	2.28	3.08

Table 36. Rotated factor matrix, all variables included in the study. Boys, N = 70

1. opposites	.56	-.18	.19	.10	.17	.04	.38	.51	-.12	.06	.19	.05
2. synonyms	.73	-.13	.27	-.04	-.18	.00	.16	.73	-.02	.07	.18	.09
3. word analogies	.51	-.09	.40	-.03	-.07	-.15	-.14	.46	.03	-.28	.06	05
4. mathematical problems	.59	.15	.51	.13	.18	.16	.13	.30	.10	.03	-.33	-.09
5. additions	.75	.09	.82	.06	-.16	-.04	.04	.16	-.06	.10	.04	.00
6. number cancelling	.24	.07	.37	-.07	-.04	.01	.24	.09	.06	-.16	.03	-.03
7. V_1/K	.64	.08	.08	-.04	.05	.07	-.09	.77	.06	.01	-.12	.04
8. V_3/K	.63	.05	.07	-.06	.05	.21	-.07	.74	-.07	.08	-.12	.03
9. S_2/K	.54	.03	.16	.16	.60	-.10	-.11	.01	.33	-.00	-.06	-.06
10. S_6/K	.58	.04	.36	-.02	.02	-.17	-.16	.36	.48	.10	.10	-.05
11. R_2/K	.64	.23	.58	.17	.26	-.12	.05	.26	.16	-.16	.09	.03
12. R_3/OK	.38	.14	.20	-.04	.20	-.09	.06	.35	-.04	-.30	.25	.08
13. N1/K	.66	.01	.78	.03	.09	.10	-.16	.04	-.01	.09	-.03	.02
14. N_2/K	.64	.17	.65	-.05	.06	.19	.00	.08	-.07	.30	-.07	.20
15. general intelligence level as rated by teachers	.72	.68	.28	-.08	.08	.10	.03	.29	.14	-.10	-.14	.15
16. carefulness	.78	.83	-.02	.12	.08	.11	-.08	-.05	-.03	.05	.21	.02
17. religion	.61	.68	-.02	-.14	-.19	-.01	.03	.16	-.18	.07	-.13	.11
18. reading (and literature)	.48	.43	.02	.03	.06	-.25	.11	.35	-.15	.05	.00	.27
19. composition	.70	.50	.35	-.02	.04	.04	.23	.46	-.19	-.01	.12	-.02
20. civics	.79	.80	.13	.18	.04	-.04	-.10	.15	-.10	-.04	-.16	.14
21. mathematics	.80	.71	.41	.11	.23	.15	-.14	.08	-.04	-.08	-.09	.04
22. book-keeping	.66	.63	.21	-.06	.08	.33	.14	.01	.08	-.16	.23	.08
23. home economics	.53	.54	-.11	.08	.07	-.02	.23	-.17	.32	-.02	-.04	-.18
24. physical education	.64	.31	.06	-.22	.02	.03	.61	-.01	-.20	.04	.12	.25
25. handcrafts	.54	.45	-.01	-.01	.36	-.03	.10	-.13	-.02	-.32	.27	-.03
26. vocational guidance	.77	.84	.09	.10	.00	.02	.04	-.12	-.06	-.05	-.12	.08
27. music	.47	.10	-.01	.01	.05	-.11	.43	.18	-.26	.36	-.12	.07
28. penmanship	.47	.24	.17	-.07	.10	-.07	.38	.04	-.43	.00	.19	-.03
29. drawing	.49	.46	-.14	-.03	.39	-.18	.24	.10	-.05	-.02	-.01	-.10
30. mean	.91	.92	.13	-.00	.14	.01	.12	-.02	.03	-.07	.06	.07
31. Sibelius, change score	.36	-.10	.13	.05	-.03	.02	.05	-.02	.08	.56	.07	.04
32. Gipsies, change score	.17	-.09	-.08	.07	-.03	-.04	-.09	-.15	.31	.05	.00	.13
33. Shift work, change score	.31	.20	-.02	-.21	-.27	-.11	-.10	.12	-.00	.31	.12	-.06
34. Total picture difference	.51	.14	.10	-.01	-.03	.67	-.05	.08	.10	.06	.05	-.00
35. Total object difference	.45	-.06	-.00	.09	-.02	.61	.00	.10	-.18	-.07	-.11	-.12
36. Attitudes towards peers	.43	.18	.11	.13	.12	-.00	.13	.05	.56	.00	.06	.11
37. Attitudes towards teachers	.40	.05	-.05	.32	.17	.22	.24	-.14	-.06	-.34	.13	.06

(Table 36 continues)

38. Attitudes towards parents	.68	.13	.15	.79	.01	-.01	-.00	.01	.03	.03	.08	-.13
39. Attitudes towards mother	.59	.07	.02	.72	-.07	.09	-.09	.00	.06	-.08	-.03	.17
40. Attitudes towards father	.72	.06	-.02	.80	.01	-.05	-.18	-.11	.14	.11	-.01	-.02
41. Change in attitudes, as rated by teachers	.45	-.20	-.07	.11	-.32	-.31	-.10	-.31	.25	.12	.03	-.09
42. Attitudes towards teachers, as rated by teachers	.68	.63	-.08	.33	.01	-.02	.03	-.13	.12	.17	.30	.08
43. Attitudes towards peers, as rated by teachers	.58	.49	-.10	.17	-.07	-.01	-.20	.09	.09	.07	.43	.21
44. Ornaments	.64	.11	.11	-.02	.75	.00	-.00	.07	-.15	-.10	-.10	.02
45. Wire bending	.51	.08	-.22	-.18	.56	.08	.17	.02	.12	.03	.22	.10
46. Attitudes towards other people	.55	.11	-.03	.33	-.05	-.24	.23	-.03	.27	.05	-.02	.48
47. Attitudes towards work	.82	.87	.03	-.05	.10	.03	-.02	.06	.05	.03	.17	-.11
48. Emotional balance	.62	.45	-.01	.26	-.01	-.22	-.12	.04	.12	.31	.38	.18
49. Activity	.46	.48	.10	.15	-.18	-.06	.29	-.07	.15	.01	-.01	.21
50. Leadership	.55	.26	.07	-.15	.29	.07	.22	.31	.17	.03	.14	.47
51. Companionship	.56	.40	.12	.01	.01	-.07	-.10	.22	.11	-.01	.08	.55
52. Social status	.30	.09	-.11	.25	-.27	.13	.03	.26	.08	-.04	-.04	-.21
53. The number of siblings	.37	-.11	-.08	-.12	.02	.00	.55	-.03	.11	-.05	-.12	-.10
Variances of factors	30.14	8.50	3,63	2,71	2,36	1,60	1,98	3,61	1,73	1,37	1,25	1,40
as percentages of number of variables	56,87	16,05	6,86	5,11	4,45	3,01	3,74	6,80	3,26	2,58	2,37	2,65

Table 37. Rotated factor matrix, all variables included in the study. Girls + Boys, N = 157

	h^2	1	2	3	4	5	6	7	8	9	10	11
1. opposites	.58	-.01	.55	.03	.07	.34	.03	-.35	.08	.02	-.12	.05
2. synonyms	.64	.04	.69	.01	-.05	.31	.09	-.18	.10	-.06	-.11	-.02
3. word analogies	.43	.09	.52	-.02	.06	.28	.05	.13	-.01	.15	-.05	.18
4. mathemathical problems	.50	.05	.27	.16	.26	.47	.13	.10	-.04	.10	.08	-.26
5. additions	.67	.10	.14	.07	.01	.77	.02	-.08	-.03	-.04	-.09	-.14
6. number cancelling	.32	.09	.00	.00	-.06	.37	.07	-.20	.10	.02	.21	.25
7. V_1/K	.60	.11	.73	-.05	.10	.09	.06	.01	.12	.05	.14	-.02
8. V_3/K	.60	.14	.74	.04	.09	-.01	.06	-.01	-.00	.05	.01	-.13
9. S_2/K	.51	.15	.12	.06	.62	.11	.05	.19	-.02	-.03	.05	.15
10. S_6/K	.40	-.02	.24	-.10	.34	.31	.14	.24	-.03	-.11	.00	.16
11. R_1/K	.43	.16	.21	.01	.39	.36	.24	.12	.06	-.00	.05	-.05
12. R_3/OK	.37	.09	.35	.10	.39	.03	.21	.00	.02	.02	-.02	-.19
13. N_1/K	.69	.14	.14	.03	.01	.80	-.08	-.02	-.01	-.06	.05	.03
14. N_2/K	.52	.22	.15	.02	-.07	.62	.04	.03	.10	.12	-.03	.18
15. general intelligence level as rated by teachers	.64	.65	.27	.00	.07	.02	.32	-.01	.06	.19	.02	.03
16. carefulness	.77	.82	.02	.11	.01	.08	-.10	-.11	.03	-.26	-.03	-.03
17. religion	.58	.65	.19	.05	-.18	.05	.02	-.20	.01	-.04	.19	-.07
18. reading (and literature)	.55	.45	.42	.08	-.00	.21	.13	-.26	-.08	-.02	.14	.10
19. composition	.61	.50	.46	.02	-.02	.11	.12	-.31	.07	.12	.02	.08
20. civics	.77	.80	.25	.11	-.03	.05	.06	-.02	-.03	-.05	.16	.13
21. mathematics	.75	.71	.14	.13	.17	.35	.06	.12	.03	.04	.13	-.13
22. book-keeping	.66	.68	.00	-.02	.19	.25	.11	.03	.20	-.06	-.02	-.22
23. home economics	.30	.47	-.13	-.09	.11	-.02	.08	-.05	.08	-.14	-.00	.08
24. physical education	.48	.17	-.01	-.01	.07	.19	.19	-.59	.09	-.05	.01	-.13
25. handcrafts	.47	.50	.06	.05	.32	.01	-.14	-.19	-.06	-.07	.13	.14
26. vocational guidance	.68	.80	.05	.08	.02	.14	.06	.04	-.02	-.06	.10	.00
27. music	.24	-.02	.16	-.01	-.05	-.11	.12	-.42	-.03	-.01	-.05	.03
28. penmanship	.38	.22	.06	.05	-.01	.05	-.09	-.54	.00	.13	-.05	.03
29. drawing	.43	.26	-.01	.05	.43	-.12	.03	-.38	.01	-.06	-.01	.03
30. mean	.88	.89	.13	.01	.12	.15	.13	-.14	.04	-.07	.05	-.01
31. Sibelius, change score	.12	-.05	.09	-.01	-.07	.11	.00	-.06	.01	-.19	-.21	.11
32. Gipsies, change score	.29	.01	-.06	.18	-.12	.02	.05	.06	.11	.00	-.05	.47
33. Shift work, change score	.20	.17	.16	-.11	-.32	.04	.00	.00	.02	-.14	-.06	.00
34. Total picture difference	.54	.06	.05	.06	-.03	.08	.01	-.01	.72	-.06	-.06	.02
35. Total object difference	.56	.06	.19	.15	-.12	-.00	-.14	-.05	.65	.12	-.00	.17
36. Attitudes towards peers	.32	.02	.07	.33	.10	.02	.23	-.04	.05	-.01	-.00	.38
37. Attitudes towards teachers	.40	.05	-.11	.44	.10	-.07	-.02	-.09	.39	.06	.07	.02

(Table 37 continues)

38. Attitudes towards parents	.54	.12	.04	.70	.00	.05	-.01	-.03	.16	-.07	-.07	.04
39. Attitudes towards mother	.66	.05	.04	.80	-.08	.05	.06	-.01	.01	-.07	-.02	.05
40. Attitudes towards father	.67	.06	.01	.77	.00	.09	-.01	.08	-.03	-.14	-.14	.12
41. Change in attitudes, as rated by teachers	.25	.03	-.15	.12	-.11	-.04	-.08	.16	-.05	-.40	.03	.06
42. Attitudes towards teachers, as rated by teachers	.66	.47	-.19	.26	.07	.01	.07	-.02	.00	-.57	.02	-.06
43. Attitudes towards peers, as rated by teachers	.61	.41	.01	.06	-.02	-.07	.08	.02	.02	-.63	.12	-.12
44. Ornaments	.53	.17	.14	-.08	.65	.06	-.03	-.00	-.01	.12	.07	-.15
45. Wire bending	.46	.05	-.05	-.14	.60	-.10	.04	-.22	-.06	-.01	-.03	-.12
46. Attitudes towards other people	.58	-.06	.01	.13	.03	.07	.69	-.12	-.10	.05	-.20	.10
47. Attitudes towards work	.76	.82	-.01	.01	.12	-.03	.01	-.01	.00	-.06	-.26	.01
48. Emotional balance	.55	.48	.03	.08	.04	.02	.11	-.00	-.04	-.44	-.32	.09
49. Activity	.58	.32	.05	.04	.01	.10	.54	-.10	-.13	.11	-.37	.04
50. Leadership	.46	.15	.24	-.13	.20	-.05	.49	-.14	-.04	-.06	.23	.07
51. Companionship	.48	.24	.17	-.01	.02	.03	.57	.02	.05	-.14	.19	-.01
52. Social status	.19	-.12	-.02	.13	-.06	-.07	.02	-.05	.05	.05	-.38	-.00
53. The number of siblings	.15	-.15	-.18	-.08	.10	-.00	-.01	-.22	.09	.13	.02	-.01
Variances of factors	26.99	7.39	3.44	2.40	2.37	2.96	1.87	1.80	1.32	1.51	.93	.98
as percentages of number of variables	50.93	13.95	6.50	4.53	4.48	5.58	3.54	3.39	2.50	2.86	1.76	1.85

The factor analyses allowed distinguishing the following dimensions.

1. Several of school achievement factors are identifiable. These will not be considered at this point, since a separate analysis of the structure of school achievement was presented above.

2. Several of intelligence factors are identifiable. The structure of intelligence was also analyzed above, and these factors will also be only referred to in this context. Some of the school achievement and intelligence factors were identified from unrotated matrices involving numerous factors.

3. The attitude variables spanned only a single factor.

4. An attitude-independent persuasibility factor is clearly in evidence. Also, an attitude-dependent persuasibility factor is identifiable, but it is weak and the communalities of the variables spanning it are low. The spanning of the factor is prevented by the fact that these variables have associations with attitude variables. The communalities could be higher, if the number of dimensions were greater.

5. A dexterity factor is clearly identifiable.

6. A sociometric factor is determined by the leadership and companionship variables and of activity and attitudes towards other people, as rated by teachers.

7. The ratings by teachers form a number of factors. The writer prefers, however, not to name these factors; since some of them must be interpreted as technical, and among the others are several for which psychological interpretations as general as those given to the other groups of factors are difficult to discover.

The factor congruence coefficients are presented in Tables 32-52.

Table 38. Congruence coefficients
Girls + Boys x Girls + Boys

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
1/1	1.00	.33	.19	.25	.32	.30	-.25	.11	-.33	.12	.00
1/2	.33	1.00	.06	.22	.47	.33	-.22	.14	.13	.08	.03
1/3	.19	.06	1.00	-.01	.14	.09	-.03	.23	-.22	-.15	.24
1/4	.25	.22	-.01	1.00	.17	.24	-.07	-.04	.02	.12	-.16
1/5	.32	.47	.14	.17	1.00	.21	-.09	.11	.02	.03	.04
1/6	.30	.33	.09	.24	.21	1.00	-.18	-.06	-.05	-.07	.10
1/7	-.25	-.22	-.03	-.07	-.09	-.18	1.00	-.11	-.06	.04	-.02
1/8	.11	.14	.23	-.04	.11	-.06	-.11	1.00	.05	.03	.14
1/9	-.33	.13	-.22	.02	.02	-.05	-.06	.05	1.00	.02	.02
1/10	.12	.08	-.15	.12	.03	-.07	.04	.03	.02	.10	-.08
1/11	.00	.03	.24	-.16	.04	.10	-.02	.14	.02	-.08	1.00

Table 39. Congruence coefficients
Girls x Girls + Boys

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
2/1	.96	.49	.17	.24	.39	.24	-.25	.12	-.26	.16	.06
2/2	.34	.67	.04	.79	.47	.37	.07	.05	.06	.12	-.14
2/3	.08	.12	.94	-.04	.18	.11	-.11	.25	-.08	-.14	.26
2/4	.17	.08	.01	.52	-.05	.12	-.70	-.04	-.07	-.08	-.23
2/5	-.20	-.37	.01	-.18	-.13	-.94	.26	.07	-.11	.06	-.14
2/6	.36	.40	.18	.06	.94	.17	-.26	.13	-.07	.03	.14
2/7	.12	.03	.31	-.08	.10	-.08	-.07	.90	-.06	-.10	.25
2/8	.20	-.24	.17	.04	-.03	.08	.03	-.04	-.17	-.81	.17
2/9	.44	-.24	.24	.0[illegible]	-.03	-.08	.11	.02	-.86	.22	-.23
2/10	-.29	-.43	-.13	.17	-.23	-.15	-.02	.07	.16	.16	.26
2/11	-.20	-.74	-.09	-.00	-.40	-.22	.40	-.19	-.02	.15	.03

Table 40. Congruence coefficients
Girls x Girls

	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
2/1	1.00	.41	.09	.13	-.19	.42	.12	.10	.34	-.30	-.34
2/2	.41	1.00	.03	.22	-.31	.31	.00	-.09	-.01	-.17	-.35
2/3	.09	.03	1.00	.05	-.02	.21	.30	.09	.07	-.06	-.17
2/4	.13	.22	.05	1.00	-.14	.04	-.05	.05	.05	.03	-.12
2/5	-.19	-.31	-.02	-.14	.10	-.10	.10	-.02	.23	.13	.27
2/6	.42	.31	.21	.04	-.10	1.00	.14	-.02	.00	-.25	-.39
2/7	.12	.00	.30	-.05	.10	.14	1.00	.10	.07	.04	-.16
2/8	.10	-.09	.09	.05	-.02	-.02	.10	.10	.06	.02	.11
2/9	.34	-.01	.07	.05	.23	.00	.07	.06	1.00	-.04	.12
2/10	-.30	-.17	-.06	.03	.13	-.25	.04	.02	-.04	1.00	.29
2/11	-.34	-.35	-.17	-.12	.27	-.39	-.16	.11	.12	.29	1.00

Table 41. Congruence coefficients
Boys x Girls + Boys

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
3/1	-.97	-.25	-.20	-.27	-.25	-.41	.30	-.09	.34	-.08	.03
3/2	.32	.53	.12	.23	.93	.27	-.03	.12	.12	.07	.03
3/3	.15	-.00	.91	.02	.11	.15	.10	.10	-.32	-.27	.21
3/4	-.26	-.17	.01	-.89	-.10	-.11	.17	-.02	-.11	-.27	.06
3/5	.08	.09	.10	-.05	.11	-.17	.01	.79	.21	.05	-.13
3/6	-.10	-.08	.04	-.17	-.10	-.28	.82	-.12	-.23	.12	.03
3/7	-.21	-.94	.03	-.22	-.39	-.34	.23	-.14	-.15	-.04	.06
3/8	-.01	.08	-.16	-.27	-.06	-.40	-.44	.02	.29	.13	-.41
3/9	.04	-.0[illegible]	.05	.31	-.11	-.05	.10	.13	.39	.34	-.11
3/10	.28	.03	.08	.17	.02	.12	-.24	.07	-.61	-.19	.00
3/11	.30	.30	.09	.07	.19	.79	-.23	-.06	-.18	.15	.11

Table 42. Congruence coefficients

Boys x Girls

	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
3/1	-.87	-.29	-.10	-.24	.29	-.30	-.09	-.22	-.42	.26	.13
3/2	.39	.54	.16	-.08	-.21	.78	.06	-.05	-.10	-.18	-.35
3/3	.12	.06	.74	-.05	-.04	.13	.21	.29	.29	-.14	-.04
3/4	-.26	-.62	.04	-.49	.09	-.04	.07	.06	-.01	-.17	-.05
3/5	.07	.01	.12	-.07	.17	.10	.55	-.07	-.05	-.04	-.08
3/6	-.08	-.02	-.05	-.51	.34	-.18	-.07	-.01	.18	-.19	.34
3/7	-.34	-.60	-.06	-.13	.36	-.32	.01	.23	.28	.31	.67
3/8	.03	-.23	-.15	.18	.25	.00	-.03	-.16	-.14	-.14	-.14
3/9	.04	.20	.03	-.02	-.01	-.14	.02	-.14	-.09	.22	.13
3/10	.25	.03	.06	.27	-.04	.09	.10	.31	.41	-.04	-.08
3/11	.28	.20	.12	.08	-.71	.23	-.06	-.06	.03	-.18	-.18

Table 43. Congruence coefficients

Boys x Boys

	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
3/1	.10	-.26	-.17	.26	-.06	.17	.18	.05	-.03	-.27	-.35
3/2	-.26	1.00	.08	-.16	.12	-.06	-.48	-.05	-.02	-.01	.17
3/3	-.17	.08	1.00	.01	-.03	.12	.07	-.25	-.04	.09	.08
3/4	.26	-.16	.01	1.00	-.06	.17	.13	.06	-.26	-.09	-.11
3/5	-.06	.12	-.03	-.06	1.00	.00	-.11	.15	.13	-.11	-.12
3/6	.17	-.06	.12	.17	.00	1.00	.12	-.20	-.04	-.08	-.12
3/7	.18	-.47	.07	.13	-.11	.12	1.00	-.06	.02	-.05	-.25
3/8	.05	-.05	-.25	.06	.15	-.20	-.06	1.00	.04	-.10	-.13
3/9	-.03	-.02	-.04	-.26	.13	-.04	.02	.04	1.00	-.03	-.11
3/10	-.27	-.01	.09	-.09	-.11	-.08	-.05	-.10	-.03	1.00	.25
3/11	-.35	.17	.08	-.11	-.12	-.12	-.25	-.13	-.11	.25	1.00

Table 44. Congruence coefficients
Girls + Boys 7 x Girls + Boys 9

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9
2/1	.99	.29	.17	.25	.29	.30	-.20	-.44	-.11
2/2	.38	.98	.03	.25	.47	.40	-.19	.20	-.25
2/3	.16	.06	.98	-.06	.14	.14	-.05	-.26	-.41
2/4	.24	.21	-.05	1.00	.17	.20	-.04	.06	.05
2/5	.34	.49	.15	.19	1.00	.20	-.08	-.01	-.09
2/6	.18	.22	.06	.20	.13	.91	-.17	-.20	.43
2/7	-.25	-.21	.03	-.08	-.10	-.23	.96	-.26	.25

Table 45. Congruence coefficients
Girls 9 x Girls + Boys 9

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9
3/1	.96	.49	.15	.23	.39	.25	-.20	-.27	-.11
3/2	.33	.60	.00	.82	.47	.33	.09	.04	-.05
3/3	.11	.15	.94	-.01	.21	.09	-.09	-.14	-.22
3/4	.14	.05	-.03	.51	-.10	.09	-.72	-.09	.09
3/5	-.21	-.46	-.01	-.19	-.15	-.91	.26	-.05	-.10
3/6	.38	.48	.17	.07	.92	.21	-.27	-.09	-.13
3/7	.14	.16	.34	-.09	.16	.01	-.17	-.05	-.87
3/8	-.06	-.68	.18	-.14	-.22	.00	.10	-.10	.05
3/9	.41	-.27	.15	.10	-.07	-.15	.16	-.85	-.03

Table 46. Congruence coefficients
Girls 7 x Girls + Boys 7

	2/1	2/2	2/3	2/4	2/5	2/6	2/7
4/1	.97	.38	.16	.20	.35	.12	-.15
4/2	.36	.79	.00	.67	.53	.25	-.01
4/3	.18	.07	.92	-.03	.19	.10	-.03
4/4	.11	-.07	-.01	.65	-.07	.19	-.45
4/5	-.18	-.62	-.01	-.14	-.18	-.67	.46
4/6	.36	.52	.16	.04	.90	.09	-.35
4/7	.06	.18	.50	-.08	.18	-.35	-.22

Table 47. Congruence coefficients
Girls 7 x Girls 9

	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
4/1	.98	.33	.09	.10	-.14	.38	.16	-.09	.50
4/2	.49	.94	.06	.11	-.41	.43	.12	-.59	-.03
4/3	.13	.01	.97	.06	-.06	.22	.35	-.02	.27
4/4	.03	.37	.02	.93	-.09	-.04	-.04	.19	.09
4/5	-.29	-.29	-.07	-.18	.87	-.20	.02	.17	.59
4/6	.48	.30	.24	.06	-.14	.98	.18	-.30	-.14
4/7	.14	.08	.36	-.12	.14	.17	.89	.26	-.23

Table 48. Congruence coefficients
Boys 9 x Girls + Boys 9

	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9
5/1	-.97	-.26	-.17	-.27	-.25	-.42	.26	.37	.09
5/2	.32	.51	.10	.26	.93	.24	.02	.13	-.12
5/3	.15	.01	.91	.03	.11	.11	.12	-.35	-.09
5/4	-.27	-.14	.03	-.88	-.08	-.12	.15	-.10	.06
5/5	.06	.11	.06	-.02	.10	-.23	-.04	.21	-.72
5/6	-.21	-.21	.05	-.09	-.17	-.26	.92	-.11	.08
5/7	-.22	-.94	.05	-.26	-.41	-.38	.19	-.10	.12
5/8	-.09	.06	-.25	-.24	-.09	-.66	-.10	.30	.05
5/9	-.07	-.12	-.04	.24	-.17	-.24	-.02	.54	-.11

Table 49. Congruence coefficients
Boys 9 x Girls 9

	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
5/1	-.87	-.29	-.12	-.19	.30	-.31	-.10	-.02	-.40
5/2	.38	.54	.17	-.14	-.20	.76	.10	-.24	-.12
5/3	.13	.07	.76	-.08	-.04	.12	.21	.19	.27
5/4	-.24	-.62	.03	-.48	.10	-.03	.06	.08	-.04
5/5	.04	.02	.10	-.07	.19	.08	.51	-.08	-.09
5/6	-.20	.00	-.03	-.54	.34	-.31	-.15	.15	.16
5/7	-.35	-.58	-.08	-.10	.47	-.40	-.11	.59	.30
5/8	-.03	-.21	-.21	-.02	.44	-.08	-.08	-.18	-.15
5/9	-.09	.09	-.04	.07	.16	-.22	.02	-.05	-.19

Table 50. Congruence coefficients
Boys 7 x Girls + Boys 7

	2/1	2/2	2/3	2/4	2/5	2/6	2/7
6/1	-.97	-.31	-.19	-.24	-.26	-.32	.28
6/2	.30	.55	.11	.27	.93	.15	-.06
6/3	.16	-.01	.90	.01	.14	.14	.16
6/4	-.25	-.16	-.01	-.90	-.05	-.06	.22
6/5	-.05	.17	-.10	-.05	.00	-.73	-.18
6/6	-.17	-.22	.08	-.07	-.15	-.18	.90
6/7	-.20	-.92	.01	-.25	-.42	-.31	.20

Table 51. Congruence coefficients
Boys 7 x Girls 7

	4/1	4/2	4/3	4/4	4/5	4/6	4/7
6/1	-.89	-.31	-.19	-.16	.28	-.31	-.05
6/2	.31	.60	.14	-.08	-.25	.74	.16
6/3	.14	.03	.79	-.01	.02	.09	.29
6/4	-.21	-.49	.02	-.56	.14	.00	-.02
6/5	-.02	.01	-.14	-.14	.17	.05	.32
6/6	-.14	-.07	.00	-.37	.38	-.33	-.02
6/7	-.23	-.71	-.04	-.04	.54	-.44	-.04

Table 52. Congruence coefficients
Boys 7 x Boys 9

	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
6/1	1.00	-.25	-.18	.26	-.04	.24	.18	.19	.11
6/2	-.28	1.00	.09	-.16	.13	-.11	-.49	-.07	-.10
6/3	-.16	.09	.99	.04	.04	.11	.04	-.29	-.08
6/4	.28	-.12	-.02	.97	-.08	.13	.09	.20	-.39
6/5	.06	.07	-.21	.00	.78	-.03	-.09	.70	.46
6/6	.22	-.09	.19	.13	-.01	.99	.19	-.14	-.13
6/7	.21	-.45	.07	.14	-.10	.20	1.00	.05	.18

The factor congruence coefficients allow the following conclusions.

1. Comparison of the congruence coefficients for the three groups studied reveals that each factor has one considerably high congruence coefficient in each row of the matrix. This indicates that the basic factors mentioned occur in each subject group. The coefficients will be discussed in greater detail in the section describing the results of transformation analysis.

2. Inspection of the correspondence figures for rotations with various numbers of factors, within each group reveals that the diagonal entries of the rectangular matrices concerned are considerable. This suggests that the configurations resulting when the number of factors included in rotation is varied are comparatively invariable, as far as the first factors are concerned. In the present study, the number of factors was varied with the objective of facilitating the interpretation of the interrelations between school achievement and other variables; in this way an attempt was made to improve the model so as to make it better capable of describing interrelations. Thus, it would appear that the variation of the number of factors, 7-11, does not affect the configuration harmfully, as far as the first factors are concerned. Comparison of the interpretation of the matrices obtained through including various numbers of factors in rotation provided additional evidence in support of this result.

3. Inspection of the congruence figures within each matrix reveals that not all of them are close to zero. This suggests that the configurations are not completely orthogonal. These congruence figures can later be used as a measure of the interdependence of factors.

5.2. Correlative Associations

The next section considers the interrelations between school achievement and the battery employed on the basis of correlations. The large number of correlation coefficients makes, however, a detailed discussion impossible. The following general observations are based on the correlation matrices (Tables 26 to 28). The correlations will be discussed in Part IV.

Several of the correlations between the intelligence and school achievement variables are high and significant.

Several of the correlations between the dexterity and school achievement variables are significant.

Several of the correlations between the rating and school achievement variables are high and significant. That a halo effect has obviously been operative here should, however, be kept in mind when these correlations are interpreted.

Between the persuasibility and school achievement variables there are a few significant correlations.

A few of the correlations between the attitude and school achievement variables are significant.

Several of the correlations between the sociometric variables and school achievement variables are significant.

Several of the correlations for the girl group between social status and school achievement variables are significant. A high social status is associated with good school achievement.

The number of siblings is associated with school achievement in such a way that there is a tendency for those who have few siblings to do well in theoretical subjects. Though the coefficients of correlation are low, they are uniformly in the same direction for the girl and boy groups. Moreover, in the boy group a large number of siblings is associated with success in practical subjects. It must, however, be pointed out that there are correlations between social status and the number of siblings.

5.3. The Associations Revealed by the Factor Analysis Model

The following account of the interrelations of school achievement and the other variables included in the study is based on the factor analysis model. The account will be made in a similar way as in the investigation of interrelations between school achievement and intelligence. In the case of each group, account will be based on an eleven -factor rotation (Tables 35 to 37), though not exclusively, since the results of the seven-factor and nine-factor rotations will also be taken into account, because they are useful. The account to be presented below co-determined the line of approach chosen when the study was continued.

The associations between school achievement and intelligence, as revealed by the present model, are similar to those presented when the factor analysis of these variables was discussed so that no re-account is necessary here.

The following associations between school achievement and other variables were in evidence.

The dexterity variables have associations with success in practical school subjects. For the girl group, the practical subjects and the dexterity variables form a single factor. For the boy group and the combined group the dexterity variables constitute (in combination with the visual ability variable) a factor. This factor explains 14 to 19 per cent of the variance of success in drawing and 10 to 13 per cent of the variance of success in handcrafts.

In the boy group and combined group, the sociometric variables obtain appreciable loadings on the theoretical subjects factor.

One of the attitude variables, attitudes towards teachers, obtains considerable loadings on the practical subjects factors. In the boy group, the attitudes towards peers variable **is** associated with penmanship in such a way that the higher a subject scored on the first, the lower did he tend to score on the second.

There is little association between attitude-independent persuasibility and school achievement. Book-keeping is the only school subject that is invariably loaded on this factor.

The associations between attitude-dependent persuasibility and school achievement are also weak. Music is the only school achievement variable that obtains, in the boy group, interpretable loadings on the attitude-dependent persuasibility factor.

In all three pupil groups, two of the rating trait variables, namely, attitudes towards work and emotional balance, obtain high loadings on the theoretical subjects factor. Another two, namely, activity and attitudes towards teachers, have high loadings on the same factor in the boy group.

For the boy group, the number of siblings obtains a high loading on the practical subjects factor.

This method does not suggest any associations between social status and school achievement.

5.4. Interrelations of Factors in the Light of Congruence Coefficients

In previous sections of this paper, factor congruence coefficients have been used for purposes of structural analysis, in order to compare various groups and results obtained by various numbers of factors, and they have been used as an indication of orthogonality. The factor congruence coefficients for a particular factor matrix may also be employed in assessing the interdependence of factors. In the case of each pupil group, the factor congruence coefficients were evaluated for the rotated seven-factor, nine-factor and eleven-factor matrices. The following account is based on the coefficients computed from the eleven-factor matrices, but use will also be made of those obtained for the seven-factor and nine-factor matrices.

The following interrelations are worthy of notice.

The theoretical subjects factors are associated with the following : verbal factors (coefficients from .18 to .40); numerical factors (.22 to .42); sociometric factors for the boy group and the total group (.30 to .34); and dexterity factors for the same two groups (.25 to .26; in the girl group, dexterity is so closely interrelated with success in practical subjects that none of the eleven dimensions is an independent dexterity factor).

The associations of practical subjects factors with other factors are difficult to interpret, since no independent practical subject factors emerged when use was made of as few as eleven dimensions. Only in the boy group, one relationship is observed invariably: the dexterity factor is interrelated with the practical subjects factor.

The factor congruence coefficients also provide information of some interest about interrelations of other factors, but this information will be discussed later.

6. Comparison of the Factor Structures of Girls and Boys through Transformation Analysis

So far, the data for the girl group, boy group and total group have been analyzed separately in this paper. The average differences between these groups will not be discussed here. Intuitive inspection and factor correspondence coefficients were employed to obtain information on structural differences between the groups. To obtain more accurate information about such difference, use was made of transformation analysis methods. Comparison will be made only between girls and boys; the combined group is not mathematically suitable for this model.

6.1. Choice of the Transformation Model

The transformation method was chosen from among the three variants for which computer programmes are available in Finland: the "naive", relativistic and symmetric methods. In the "naive" method (Ahmavaara 1954 and 1957; Vahervuo & Ahmavaara 1958; and Markkanen 1964), two groups, G_1 and G_2, say, are subjected to comparison; if the factor matrices obtained for the two groups with the same set of variables are A_1 and A_2 respectively, an attempt is made to find a transformation matrix L_{12} which will minimize the sum of squares of elements of the residual matrix $A_1L_{12} - A_2 = E_{12}$, without imposing any restrictions on the matrix L_{12}. The method has the shortcoming that it does not satisfy the requirement of symmetry of the first kind (see below). In an ideal case (where the residuals vanish), the equation $A_1L_{12} = A_2$ is descriptive of the transformation $G_1 \longrightarrow G_2$, and then, $A_1 = A_2L_{21} = A_2 L_{12}^{-1}$. The transformation matrix L_{21}, providing information on the invariance of factors in the direction $G_2 \rightarrow G_1$, will in this case satisfy the requirement $L_{21} = L_{12}^{-1}$ (concerning symmetry of the first kind). This is not so for the "naive" method (Mustonen 1966, pp. 3-4). In practice this means that the results of the "naive" method depend on the direction of transformation. Therefore, attempts have been made to compare different transformation methods with each other (Mustonen 1966; Kyöstiö 1967).

In the relativistic method, developed by Ahmavaara, the factor matrices are compared on the basis of an "average matrix". Also, "abnormal" or divergent transformation in each group is measured with respect to the average matrix (Ahmavaara 1963).

Mustonen found that of the results yielded by the "naive", relativistic and symmetric methods, those obtained by the relativistic method were the least satisfactory. (Mustonen 1966, pp. 37-39).

In the symmetric transformation method, developed by Mustonen, the total residual is minimized, subject to the condition that the requirements concerning the first and second kinds of symmetry be satisfied. More specifically, the sum of squares of elements of the residual matrix $E_{12} = A_1 L_{12} - A_2$ is minimized, subject to the two symmetry requirements. The requirement concerning the first kind of symmetry can be expressed as $L_{21} = L_{12}^{-1}$. The requirement of the second kind of symmetry means that the covariance matrices of the residual variables have to be the same, irrespective of the direction of transformation, or $E_{12} E'_{12} = E_{21} E'_{21}$.

If the distributions of variables and factors are assumed to be multi-normal, the equality of the residual covariance matrices implies that the distributions of the residual variables are the same, irrespective of the direction of transformation.

Mustonen's symmetric method was employed in the present study, because divergent transformation will then be to a large extent similar regardless of the direction of transformation. Moreover, the transformation matrices will be orthogonal, and orthogonal rotations have no effect on the results. The orthogonal rotations performed in the present study resulted in configurations which were perhaps not perfectly orthogonal. Thus, this point is immaterial when use is made of the symmetric technique.

The results of transformation analysis provide information about the invariance of the factors for the various pupil groups, and they also indicate which variables mainly make for between-groups variability.

The calculations were performed at the computer centre of the University of Helsinki Institute for Nuclear Physics on Elliot 803 by employing the SYMTRA programme. The following comparisons are based on the eleven-factor varimax rotations for girls and boys.

6.2. Results of the Transformation Analysis

The two groups were compared on the basis of the transformation matrix L(2,3), providing information on interrelations between the factors for these groups (Table 53). The matrix does not, however, contain any directly quantitative information on the closeness of the interrelations. The interrelations are schematically illustrated in Figure 1. A similar schematic representation based on the congruence coefficients (Table 42) will also be given in Figure 2. Thus, the comparison can be performed on the basis of two different methods.

Table 53. Matrix L(2,3), transformation matrix.
2 = girls, 3 = boys

	1	2	3	4	5	6	7	8	9	10	11
1.	.94	.08	-.05	-.04	.01	.03	.15	-.12	-.24	-.11	-.07
2.	-.03	.28	.03	.71	.03	-.28	.45	.36	-.07	.01	-.03
3.	-.04	.04	.96	-.05	-.04	.09	.04	-.04	-.23	-.11	.06
4.	.06	-.20	.04	.59	-.01	.60	-.06	-.42	.19	.19	.05
5.	-.08	.08	.07	.10	.11	-.32	-.14	-.43	-.04	.08	-.81
6.	-.00	.92	-.00	-.10	.02	.19	-.17	-.12	.21	.12	.10
7.	.03	-.04	.05	-.05	.97	.13	-.02	.18	-.00	.11	-.01
8.	.20	-.08	.17	-.03	-.15	.23	-.14	.55	.57	-.09	-.44
9.	.22	-.10	.17	.05	-.08	-.39	-.31	.09	.11	.77	.21
10.	-.09	.07	-.14	.02	-.15	.40	-.24	.36	-.67	.28	-.26
11.	.08	.02	-.01	.35	.07	-.21	-.74	.07	-.09	-.48	.17

Figure 1. Similarities between the structures of the girl group and boy group based on the transformation matrix

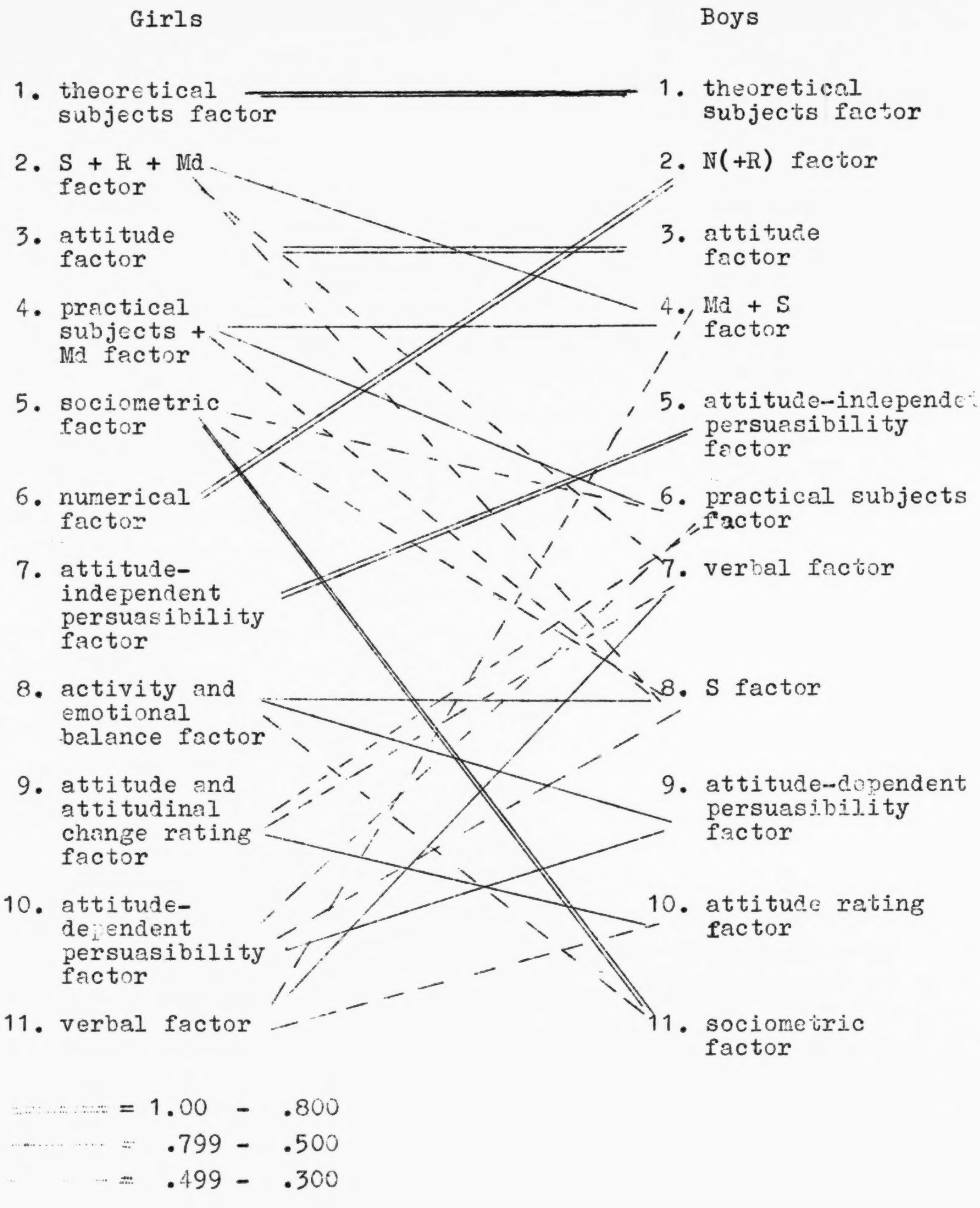
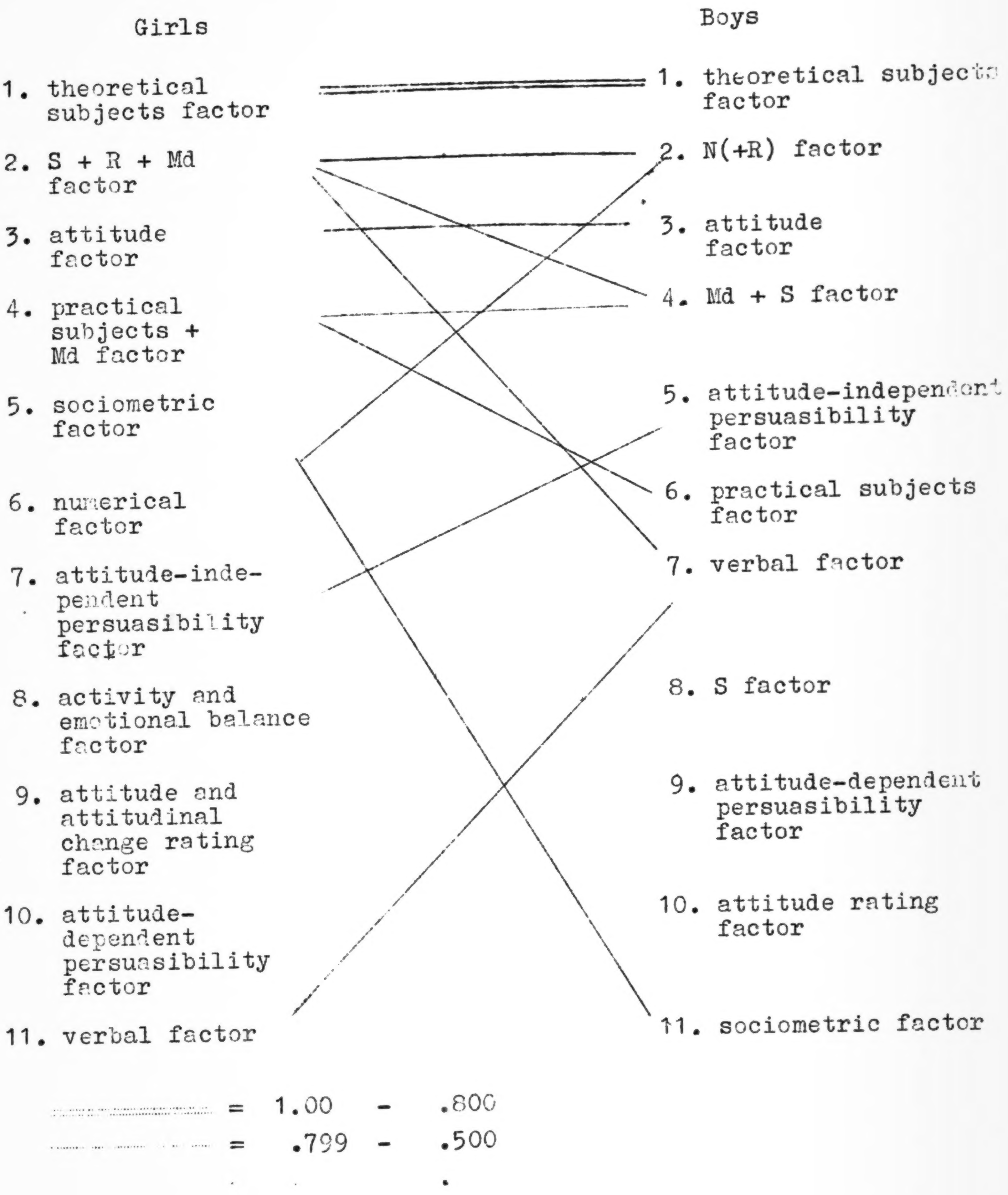

Girls
Boys
1. theoretical subjects factor
2. S + R + Md factor
3. attitude factor
4. practical subjects + Md factor
5. sociometric factor
6. numerical factor
7. attitude-independent persuasibility factor
8. activity and emotional balance factor
9. attitude and attitudinal change rating factor
10. attitude-dependent persuasibility factor
11. verbal factor
1. theoretical subjects factor
2. N(+R) factor
3. attitude factor
4. Md + S factor
5. attitude-independe
persuasibility factor
6. practical subjects factor
7. verbal factor
8. S factor
9. attitude-dependent persuasibility factor
10. attitude rating factor
11. sociometric factor
═══ = 1.00 - .800
─── = .799 - .500
– – – = .499 - .300

Figure 2. Similarities between the structures of the girl group and boy group based on the congruence coefficients


Girls
Boys
1. theoretical subjects factor
2. S + R + Md factor
3. attitude factor
4. practical subjects + Md factor
5. sociometric factor
6. numerical factor
7. attitude-independent persuasibility factor
8. activity and emotional balance factor
9. attitude and attitudinal change rating factor
10. attitude-dependent persuasibility factor
11. verbal factor
1. theoretical subjects factor
2. N(+R) factor
3. attitude factor
4. Md + S factor
5. attitude-independent persuasibility factor
6. practical subjects factor
7. verbal factor
8. S factor
9. attitude-dependent persuasibility factor
10. attitude rating factor
11. sociometric factor
= 1.00 - .800
= .799 - .500

It will be noted that, in the upper range, the factor correspondence coefficients are smaller in absolute value than the coefficients in the transformation matrix, and vice versa. Therefore, correspondence coefficients smaller than .500 in numerical value have not been represented in Figure 2. In several studies, some of which are even rather extensive (e.g., Pitkänen 1967; Ruoppila 1967), factor structures have been compared on the basis of congruence coefficients alone, and thus it would be of some interest to compare the absolute values of correspondence coefficients and transformation matrix coefficients somewhat in detail. Such a comparison will not, however, be undertaken here.

The following observations concerning similarities between the structures of the girl group and boy group can be made from the transformation matrix (Table 53) and the correspondence coefficient matrix (Table 42). (The three groups of numerical values, as distinguished in the Figures, will be indicated by speaking respectively of very good, good and moderate correspondence.)

There is a very good correspondence between the two groups in the following: the theoretical subjects factors, attitude factors, sociometric factors, factors of attitude-independent persuasibility and numerical factors. The correspondence is good in the case of the factors of attitude-dependent persuasibility, verbal factors, dexterity factors, reasoning factors and attitude rating factors. The composite factor of practical school subjects and dexterity, obtained for girls, bears a good correspondence to the separate factors of practical school subjects and dexterity, as obtained with boys. The Factor 8 of girls, which is spanned by activity and emotional balance as rated by teachers, has no counterpart capable of meaningful interpretation; the factors of boys corresponding to it are Factors 8, 9 and 11.

The information provided by the transformation matrix on structural invariance can be supplemented by considering the residuals, factor by factor; i.e. the matrices Diag $E(2,3)'E(2,3)$ and Diag $E(3,2)'E(3,2)$ in Tables 54 and 55.

Table 54. Matrix Diag $E(2,3)'E(2,3)$, residuals, by factors 2=girls, 3=boys

1. theoretical subjects factor	1.64
2. N(+R) factor	1.09
3. attitude factor	1.16
4. Md+S factor	1.08
5. attitude-independent persuasibility factor	1.35
6. practical subjects factor	1.33
7. verbal factor	1.25
8. S factor (combined with some attitude and practical subjects variables)	1.60
9. attitude-dependent persuasibility factor	1.61
10. attitude rating factor	1.84
11. sociometric factor	0.87
total residual	14.82

Table 55. Matrix Diag $E(3,2)'E(3,2)$, residuals, by factors 2=girls, 3=boys

1. theoretical subjects factor	1.77
2. S+R+Md factor	0.91
3. attitude factor	1.24
4. practical subjects + Md factor	1.24
5. sociometric factor	0.80
6. numerical factor	1.23
7. attitude-independent persuasibility factor	1.31
8. activity and emotional balance factor	1.92
9. attitude and attitudinal change rating factor	1.81
10. attitude-dependent persuasibility factor	1.37
11. verbal factor	1.82
total residual	14.82

When the factor configuration for boys is represented in the factor space for girls,the residuals of the following factors are among the smallest:the sociometric factor,the S+R+Md factor,the numerical factor,the attitude factor, the practical subjects +Md factor and the attitude-independent persuasibility factor.The residuals of the following factors are among the largest:the activity and emotional balance factor,the attitude and attitudinal change rating factor, the verbal factor and the theoretical subjects factor.

When the factor configuration for girls is represented in the factor space of boys,the residuals of the following factors are among the smallest:the sociometric factor,the Md+S factor,the N(+R)factor and the attitude factor.The residuals of the following factors are among the largest:the attitude rating factor,the theoretical subjects factor,the attitude-dependent persuasibility factor and the S factor(combined with some attitude and practical subjects variables).

More detailed information on divergent transformation is obtainable from the residuals of individual variables in the matrix DiagE(2,3),Diag E(3,2),DiagE(2,3)E(2,3)'.Each of these residuals can be broken down into (a) the difference between the lengths of the counterpart vectors and (b) the angle extended by these two.Information on these is given in Tables 56 to 58.

Table 56. Matrix E(2,3), residual matrix

	1	2	3	4	5	6	7	8	9	10	11
1	.35	.33	-.07	-.26	-.07	-.10	.03	.02	.05	-.03	-.01
2	.39	.10	.13	.13	.04	.01	-.12	.03	-.04	.02	-.12
3	.24	-.03	-.00	.14	.25	.04	.02	.08	.38	-.25	-.06
4	-.19	-.07	.09	.01	-.33	-.32	.13	-.10	-.08	.48	.20
5	.02	-.16	.10	.15	.05	.19	-.00	-.06	.10	.17	-.02
6	.04	.11	.00	-.11	-.00	-.00	-.26	-.03	.00	.08	.19
7	.08	.18	-.05	.16	.07	-.02	-.16	-.23	-.10	.11	.10
8	.22	-.01	.14	.16	-.23	-.00	-.09	-.03	-.02	.09	.13
9	.24	-.00	-.15	-.06	.08	.10	.23	-.00	-.12	.17	.02
10	-.05	.02	-.04	.44	.22	.11	-.27	-.28	-.24	-.16	.08
11	-.14	-.28	-.26	-.02	.21	-.14	.00	.12	.09	-.00	.09
12	-.05	-.20	.24	.23	.06	-.12	.09	.27	.30	-.24	.09
13	.18	-.00	.01	-.11	-.07	.21	.00	-.15	.12	.15	.00
14	.03	.04	.10	-.13	-.02	.00	-.13	.13	-.27	-.17	-.23
15	-.02	-.30	.05	-.09	-.17	.14	-.02	-.00	-.09	-.01	-.01
16	-.00	.16	.00	-.07	-.00	.06	.01	-.23	.09	-.09	-.06
17	-.02	.15	.21	.17	.12	.00	-.02	-.10	-.26	.24	-.01
18	.08	.40	.02	-.08	.27	.01	.08	.00	-.13	-.03	-.16
19	.08	-.26	.00	-.01	-.09	-.02	-.14	.12	-.14	-.33	.16
20	.01	.06	-.22	-.03	.03	-.04	.05	.04	-.12	.29	-.14
21	-.04	.05	-.03	-.06	-.16	-.06	-.00	-.02	-.00	.06	.01
22	.13	.04	.09	.06	-.19	-.20	.08	-.01	.19	-.15	-.08
23	-.10	.15	-.32	-.06	.15	-.34	.18	-.42	.19	.13	.33
24	-.20	.16	.37	.09	.06	-.15	.08	-.05	.02	.25	-.00
25	.07	.14	.00	-.10	-.06	-.00	.21	-.06	.19	-.09	-.06
26	-.06	.10	-.07	-.08	-.01	-.17	.32	.16	-.12	.24	-.08
27	-.17	-.17	-.14	.05	-.02	-.24	-.10	.20	-.27	.13	.07
28	-.03	-.15	.15	-.00	.07	-.00	-.06	.12	.10	-.31	-.05
29	-.30	.05	.16	.13	.24	.15	-.11	-.00	.03	.21	.12
30	-.04	.09	-.04	-.10	.07	-.07	.28	-.12	.04	.06	.01
31	.14	-.15	-.01	-.11	.10	.05	.20	-.04	-.48	.08	-.10
32	.17	.21	.15	-.26	.19	.25	.06	-.09	-.23	-.14	-.21
33	-.04	.01	.19	-.02	.34	-.02	.07	-.15	-.09	-.19	.17
34	-.15	-.06	.14	.09	.05	.15	-.09	-.03	.06	.07	.03
35	.14	.09	.04	-.11	.05	.12	.07	.35	-.04	.22	-.03
36	-.33	-.04	.40	-.19	-.06	.02	.06	-.54	-.20	-.12	-.06
37	-.03	-.04	.16	-.28	.25	-.18	.15	.21	.05	.00	-.10
38	-.00	-.13	-.14	-.05	.16	.14	.00	-.02	-.29	.06	.11
39	.00	.06	.09	.05	-.05	.10	-.02	-.22	.15	-.05	-.05
40	.04	.19	-.01	-.00	.14	.17	.07	-.20	-.06	-.07	.10
41	.54	-.06	.08	.30	.35	-.17	.16	-.20	-.18	.45	.16
42	-.22	.12	-.03	.09	-.06	-.36	-.20	-.04	-.03	.15	.02
43	-.06	.03	-.13	.07	-.09	-.10	-.27	-.15	-.05	.16	-.09
44	.07	-.01	-.09	-.13	.06	-.03	.21	.24	.13	.12	-.06
45	-.00	.13	.07	.04	-.18	.10	.05	-.22	-.02	-.18	-.12
46	-.19	.09	-.28	.06	.19	.20	.24	.04	.19	-.26	.00
47	-.09	-.05	.13	-.08	-.06	.07	-.10	.18	.10	-.19	-.17
48	.16	.00	-.13	.01	.19	.13	-.08	.12	.01	-.17	.42
49	-.23	-.00	-.13	.19	-.13	.00	.37	.28	.32	-.17	.12
50	-.12	-.13	-.04	-.19	-.28	.13	-.12	-.04	-.23	-.13	.03
51	-.22	-.09	-.03	.00	.11	.13	-.05	.10	-.03	-.07	-.01
52	-.28	-.03	-.06	.15	-.16	.30	-.27	.11	.26	-.03	-.04
53	-.06	.05	.01	.00	.09	-.38	-.07	-.05	-.11	.22	-.05

Table 57. Matrix E (3,2), residual matrix

	1	2	3	4	5	6	7	8	9	10	11
1	-.36	.06	.07	.27	.02	-.31	.08	-.07	-.03	.08	.05
2	-.36	-.08	-.10	-.07	-.11	-.08	-.06	-.14	-.12	-.06	-.14
3	-.15	-.09	.09	-.11	.01	.00	-.23	-.33	.13	.32	-.14
4	.21	-.10	-.06	.05	.01	.08	.33	.30	-.48	.00	.27
5	.02	.02	-.06	-.32	-.01	.07	-.09	-.08	-.10	-.00	.08
6	.00	.18	-.00	.02	.10	-.18	-.01	.07	-.18	-.01	-.15
7	-.10	-.01	.03	-.15	-.09	-.20	-.03	.24	-.13	-.02	-.15
8	-.17	-.04	-.13	-.15	.08	.00	.21	-.01	-.23	-.01	-.10
9	-.28	-.02	.12	-.03	.09	.01	-.10	.09	-.02	-.09	.26
10	-.00	-.08	-.02	-.38	-.12	-.02	-.13	.32	.13	-.09	-.44
11	.18	.01	.29	.09	.09	.27	-.21	.03	-.02	.10	-.03
12	.16	-.27	-.15	-.00	.16	.23	-.07	-.29	.02	.31	-.15
13	-.15	.21	.00	-.18	.03	-.11	.04	-.07	-.07	.03	.17
14	-.10	.07	-.16	.22	-.13	.04	.00	-.08	.14	-.26	-.13
15	.02	.19	-.08	-.07	.07	.26	.13	-.04	.03	-.11	.05
16	-.03	.10	-.01	-.05	-.12	-.19	.05	.03	.15	.12	.03
17	-.01	-.14	-.23	-.11	-.14	-.11	-.12	.22	-.16	-.19	.01
18	-.17	-.10	-.06	.16	-.16	-.32	-.25	.05	.15	-.08	.05
19	-.08	.10	-.05	.08	.21	.29	.09	-.01	.12	-.01	-.30
20	-.03	-.05	.22	.06	-.12	-.03	-.05	.06	-.14	-.21	.18
21	.04	.02	.02	.06	-.00	-.05	.17	.03	-.06	-.02	.04
22	-.10	-.12	-.04	.07	-.09	.00	.23	-.16	.00	.25	-.03
23	.08	.00	.35	.05	-.00	-.19	-.01	.49	-.12	.47	.12
24	.22	-.19	-.32	-.00	-.15	-.13	-.05	-.08	-.22	.07	.14
25	-.09	-.02	.01	.06	-.02	-.13	.09	-.09	.13	.20	.17
26	.01	-.23	.06	.24	-.03	.01	-.00	.07	-.09	-.10	.34
27	.17	-.09	.11	.19	.04	.25	.00	.17	-.19	-.22	-.11
28	.06	.02	-.13	.06	.02	.16	-.07	-.20	.17	.12	-.18
29	.34	-.03	-.14	-.21	.03	-.13	-.26	.08	-.11	-.06	-.00
30	-.00	-.06	.04	.07	-.03	-.07	-.03	.14	.05	.15	.27
31	-.28	.02	-.08	.07	-.06	.24	-.12	.25	.07	-.29	.20
32	-.29	.17	-.23	.07	-.12	-.19	-.20	.00	.30	-.16	.11
33	-.01	.01	-.23	.01	.03	.00	-.28	.24	.15	.19	-.08
34	.19	.04	-.12	-.20	.01	-.00	-.08	-.03	-.03	-.02	-.02
35	-.10	-.07	-.03	.12	.15	-.08	-.15	-.21	-.13	-.23	.19
36	.19	.29	-.48	-.06	-.29	.02	.15	.36	.21	.10	.12
37	.04	-.00	-.12	.36	-.04	.09	-.27	-.12	-.02	.10	.17
38	-.06	.10	.06	-.03	.11	.13	-.18	.24	.04	-.22	.02
39	.00	.07	-.07	-.19	-.11	-.12	.08	-.03	.07	.14	-.00
40	-.11	.04	-.04	-.12	.03	-.21	-.10	.18	.17	.03	.02
41	-.52	-.26	-.03	-.25	-.05	.09	-.33	.32	-.49	.09	.09
42	.25	-.09	.06	.14	-.18	-.08	.11	.17	-.26	.00	-.17
43	.08	.08	.15	-.06	-.22	-.06	.11	.09	-.17	-.11	-.13
44	-.04	-.08	.14	.16	.08	.03	-.11	-.19	-.05	.02	.25
45	-.06	.01	-.12	-.11	-.13	-.11	.22	.02	.23	.02	.00
46	.14	-.12	.26	-.06	.11	-.08	-.16	-.05	.44	.13	.08
47	.12	.07	-.11	.09	-.03	.05	.02	-.30	.14	-.03	-.08
48	-.18	.00	.15	.01	-.24	.02	-.20	-.30	.23	-.14	-.08
49	.26	-.37	.17	.01	.28	.06	.13	-.19	.21	.22	.13
50	.06	.27	-.05	.05	.09	.11	.26	.08	.15	-.22	-.05
51	.21	.03	.01	-.02	.02	.08	-.13	-.03	.15	-.12	-.04
52	.37	.08	.10	-.27	.07	-.09	.11	-.30	.08	-.11	-.15
53	.06	-.09	.02	.19	-.25	.00	-.05	.19	-.29	.00	-.02

Table 58. Differences in length and direction

1. Communalities for girl group
2. Communalities for boy group
3. Differences in length
4. Angular separation
M. Residuals, by variables

		1.	2.	3.	4.	M.
1.	opposites	.73	.56	.01	.74	.34
2.	synonyms	.66	.73	.00	.83	.24
3.	word analogies	.48	.51	.00	.63	.37
4.	mathemathical problems	.58	.59	.00	.50	.58
5.	additions	.65	.75	.00	.90	.15
6.	number cancelling	.42	.24	.03	.81	.15
7.	V_1/K	.60	.63	.00	.84	.19
8.	V_3/K	.59	.63	.00	.84	.19
9.	S_2/K	.57	.54	.00	.82	.21
10.	S_6/K	.44	.57	.01	.50	.51
11.	R_2/K	.36	.63	.04	.76	.27
12.	R_3/OK	.50	.38	.01	.53	.42
13.	N_1/K	.74	.66	.00	.89	.16
14.	N_2/K	.63	.64	.00	.82	.23
15.	general intelligence level as rated by teachers	.64	.72	.00	.88	.17
16.	carefulness	.83	.78	.00	.93	.11
17.	religion	.63	.61	.00	.79	.26
18.	reading and literature	.69	.48	.02	.75	.30
19.	composition	.60	.70	.00	.79	.28
20.	civics	.81	.79	.00	.88	.19
21.	mathematics	.75	.79	.00	.97	.05
22.	book-keeping	.71	.66	.00	.86	.19
23.	home economics	.36	.53	.02	.25	.67
24.	physical education	.58	.64	.00	.74	.32
25.	handcrafts	.44	.53	.00	.86	.14
26.	vocational guidance	.75	.77	.00	.82	.27
27.	music	.15	.47	.09	.62	.29
28.	penmanship	.32	.47	.01	.78	.18
29.	drawing	.53	.49	.00	.71	.30
30.	mean	.92	.91	.00	.92	.14
31.	Sibelius, change score	.12	.36	.07	.28	.37
32.	Gipsies, change score	.33	.17	.03	.20	.41
33.	shift work, change score	.31	.31	.00	.58	.26
34.	total picture difference	.60	.50	.00	.91	.10
35.	total object difference	.61	.45	.01	.78	.25
36.	attitudes towards peers	.40	.43	.00	.18	.68
37.	attitudes towards teachers	.62	.40	.02	.73	.30
38.	attitudes towards parents	.56	.68	.01	.85	.20
39.	attitudes towards mother	.74	.59	.01	.92	.11
40.	attitudes towards father	.68	.72	.00	.89	.16
41.	change in attitudes, as rated by teachers	.52	.44	.00	.07	.89
42. 43	attitudes towards teachers, as rated by teachers	.73	.68	.00	.80	.28
43.	attitudes towards peers, as rated by teachers	.69	.58	.01	.86	.18

(Table 58 continues)

44. ornaments	.54	.64	.00	.85	.19
45. wire bending	.50	.51	.00	.83	.17
46. attitude towards other people	.72	.54	.01	.71	.38
47. attitude towards work	.77	.82	.00	.89	.17
48. emotional balance	.67	.62	.00	.74	.33
49. activity	.73	.45	.03	.60	.50
50. leadership	.49	.55	.00	.74	.27
51. companionship	.37	.56	.02	.90	.11
52. social status	.38	.29	.01	.42	.39
53. the number of siblings	.15	.37	.05	.59	.25

Let us first consider the differences in length. These can be interpreted as being due to differences in the psychometric characteristics of the variables. The greatest differences in length are met in the criterion variables 27 (music), 18 (reading) and 23 (home economics) and in the explanatory variables 31 (Sibelius, change), 53 (number of siblings), 11 (R_2/K), 49 (activity), 6 (number cancelling), 32 (gipsies, change) and 37 (attitudes towards teachers).

The differences in direction are interpretable as differences in meaning of significance. They are indicated by cosine of the angles extended by the counterpart vectors. Hence, if the numerical value equals unity, there is no difference in direction. Employing the residual matrix, these differences could be analyzed factor by factor. Such analysis will not, however, be undertaken here.

The largest differences in direction are shown by the criter variables 23 (home economics) and 27 (music) and by the following explanatory variables: 41 (rated attitudinal change), 36 (attitudes towards peers), 32 (gipsies, change), 31 (Sibelius, change), 52 (social status) 4 (mathematical problems), 10 (S_6/K), 12 (R_3/OK), 33 (shift work, change) and 49 (activity).

The results of transformation analysis may be summarized as follows:

1. Judging by the transformation indices, structural variability is greatest in the rating variables. This suggests that this group of variables be subjected to further analysis. It also indicates that the ratings given to girls and those given to boys do not rest on a similar basis.
2. Both the differences in length and differences in direction are comparatively large in the case of the variables indicating attitude-dependent persuasibility, even though vectors corresponding to each other are easily identifiable. In a previous study on persuasibility (Niskanen 1964) the writer discovered that there is a tendency for the variables of attitude-dependent persuasibility to obtain loadings on the factor representing the attitudes themselves. The residuals in the present study are likely to reflect this fact, among others, since a small number of dimensions excludes the emergence of specific attitude and persuasibility factors.
3. In the group of intelligence factors, the differences are smallest in the numerical and verbal factors and largest in the reasoning and visualization factors. When a decision was made on the numbers of intelligence factors to be rotated, it was found that the factor space of girls involved fewer dimensions than that of boys. Transformation analysis provided information on qualitative aspects of this lower dimensionality.
4. Transformation analysis does not result in a very distinct picture of the structure of school achievement, as the number of dimensions employed is small, and therefore, only one theoretical subjects factor and one practical subjects factor are obtained. When the differences are considered variable by variable, it is observed, however, that those in music, reading and

home economics are the largest.

5. In the group of explanatory factors, the variances of the attitude factor, sociometric factor, the factor of attitude-independent persuasibility, verbal factor and numerical factor are the smallest.

When the results yielded by transformation analysis are analyzed, it should be kept in mind that the variables included in the battery differ in character and that the number of dimensions is low.

The information provided by transformation analysis on structural invariance can be utilized both in the interpretation of results and in their further analysis. The factor structures differ to such an extent that it seems advisable to keep the groups also separate in further computational operations. The traits rated by teachers do not form interpretable dimensions common to various pupil groups. Therefore, the rating trait variables will be excluded from subsequent operations taking place at the factor level. On the other hand, in operations at the variable level they might be helpful in the explanation of school achievement.

7. Canonical Analysis at the Variable Level

The computations described in the preceding sections provided information, based on correlations, about the interrelations between school achievement and other groups of variables, and it was possible to test this information for statistical significance. Yet, the large number of correlation coefficients made this information difficult to interpret. Therefore, factor analytical models were resorted to, with the object of condensing the information. The deficiencies inherent in factor models as indications of interrelations were discussed earlier. The intention in the following is to find an analysis model which, at the same time as it allows effectively reducing the number of dimensions, provides information on interrelations of groups of variables that can be tested for statistical significance.

The school achievement variables will be considered as dependent and the other variables as independent variables. Thus, either the multiple correlation analysis or the multiple regression analysis could be employed. The factor analyses that were performed indicated, however, that the number of dimensions of school achievement was comparatively large even after factor analysis was applied. Hence, the use of a regression model would make it necessary to perform several regression operations. Therefore, canonical analysis was chosen here. The canonical analysis model reduces the dimensionality of both the dependent and the independent variables, yields mutually independent axes for both groups and results in correlation coefficients indicating the relationships between the pairs of axes obtained, which coefficients can be tested for statistical significance.

7.1. The Principles Underlying Canonical Analysis

The canonical analysis was developed by Bartlet and Hotelling during the 1930's. In recent years it has been discussed in a number of statistical text-books (Kendall 1961, pp. 68-85; Cooley-Lohnes 1962, pp. 35-37 and 40-45; Anderson 1962, pp. 287-306; Seal 1964, pp. 124-152; Morrison 1967, pp. 213-220). Canonical correlations are maximum correlations between the linear vectors corresponding to two sets of variables. If N measurements have been made on the same group of subjects in such a way that there are p predictor variables and q criterion variables, and x_{ij} and y_{ij} represent various groups of measurements, the canonical correlation can be presented algebraically as:

$$\begin{array}{llll}
\hat{x}_1 = a_1x_{11}+a_2x_{12}+\ldots+a_px_{1p}; & b_1y_{11}+b_2y_{12}+\ldots+b_qy_{1q} = \hat{y}_1 \\
\hat{x}_2 = a_1x_{21}+a_2x_{22}+\ldots+a_px_{2p}; & b_1y_{21}+b_2y_{22}+\ldots+b_qy_{2q} = \hat{y}_2 \\
\cdot \quad \cdot \quad \cdot \qquad \cdot \qquad \cdot & \cdot \qquad \cdot \qquad \cdot \quad \cdot \\
\cdot \quad \cdot \quad \cdot \qquad \cdot \qquad \cdot & \cdot \qquad \cdot \qquad \cdot \quad \cdot \\
\cdot \quad \cdot \quad \cdot \qquad \cdot \qquad \cdot & \cdot \qquad \cdot \qquad \cdot \quad \cdot \\
\hat{x}_N = a_1x_{N1}+a_2x_{N2}+\ldots+a_px_{Np}; & b_1y_{N1}+b_2y_{N2}+\ldots+b_qy_{Nq} = \hat{y}_N
\end{array}$$

The problem consists in finding two types of weights, a and b , which will maximize the correlation between x and y, which are termed the canonical variates. The maximum number of linear variant pairs is determined by the smaller of the two sets of variables p and q.The variates x_1, x_2, x_3,...x_N and, correspondingly, the variates y_1, y_2, y_3,...y_N are orthogonal to one another.

The computation of canonical correlations is started from the covariance matrix, which contains the intercorrelations of the criterion and predictor variables and the correlations between the variables in these two groups (R_{11}, R_{22}, R_{12}, R_{21}). The partioned correlation matrices are substituted into the initial equation of the canonical analysis $(R_{22}^{-1}\ R_{21}\ R_{11}^{-1}\ R_{12} - \lambda_i I)\ b_i = 0$. The vector a_i is computed from eguation $a_i = (R_{11}^{-1}\ R_{12}b_i)/\sqrt{\lambda_i}$. The vectors a_i and b_i are normalized in such a way that $a_i^2 = b_i^2 = 1$.The canonical correlation is $Rc_i = \sqrt{\lambda_i}$. The canonical correlation are tested for statistical significance by employing Bartlett's lambda-values and the Chi-square test; the number of degrees of freedom for the first pair of vectors is p x q, and after this both factors of the product will be reduced by the ordinal number of the axis minus 1. The canonical correlations for the present study were computed at the Computer Centre of the Finnish State by Elliot 503. The programme employed was Canon (Cooley & Lohnes 1962, pp. 52-54).

7.2. The Results of the Canonical Analysis

The information provided by the canonical analysis is presented in Tables 59 - 61.

Table 59. Canonical analysis, Girls, $N = 86$, $M_1 = 38$
$M_2 = 15$

	Eigenvalue	Rc	Lambda	Khi^2	NDF	p <
1.	.94	.97	.00	829.65	570	.01
2.	.83	.91	.00	659.14	518	.01
3.	.82	.90	.00	551.42	468	.01
4.	.77	.87	.00	447.99	420	.01
5.	.68	.82	.00	361.22	374	.01
6.	.57	.76	.00	293.65	330	.01
7.	.57	.75	.01	242.55	288	.01
8.	.53	.73	.03	192.56	248	.01
9.	.48	.69	.08	147.60	210	
10.	.39	.62	.16	108.00	174	
11.	.31	.55	.26	78.48	140	
12.	.27	.52	.38	56.52	108	
13.	.24	.49	.53	37.32	78	
14.	.18	.43	.70	20.83	50	
15.	.13	.36	.86	8.56	24	

(Table 59 continues)

M$_1$ vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 ...
1	.04	-.00	.19	-.05	-.07	-.04	.05	.03	.07	.19	-.04	-.14	.14	-.03	-.09
2	-.32	.07	-.03	-.05	.17	.24	-.15	.10	-.04	-.10	-.06	.07	-.24	.02	-.01
3	-.07	.00	-.12	.13	.04	.03	-.10	.03	-.09	.05	-.23	-.01	-.04	-.12	-.14
4	-.00	.01	.16	.03	.12	.31	-.02	.12	.07	-.15	.00	-.13	.11	.19	-.09
5	-.15	-.41	.33	-.19	-.11	.17	.00	.04	.13	.06	-.05	.08	-.23	.00	.04
6	.14	-.11	-.17	.12	.28	-.17	-.09	.11	.25	-.11	.13	-.22	-.25	.06	-.45
7	.33	.19	-.28	-.24	-.08	-.03	.27	-.44	-.24	.21	-.16	-.00	.23	.02	.28
8	-.02	.18	-.04	.17	-.06	-.54	.19	-.00	-.29	-.02	.15	.18	.20	.10	-.09
9	-.01	.02	.04	-.26	.07	.11	-.27	.18	.16	.15	-.06	-.10	-.10	.16	-.35
10	.01	-.25	-.00	.09	-.05	-.32	.29	.25	.05	-.19	-.20	.00	-.00	.11	.25
11	.04	.07	.24	-.23	-.08	.23	.18	.29	-.12	.06	.26	-.08	[illegible]	-.24	-.18
12	.25	.11	-.20	.25	-.23	-.18	-.01	.19	.11	-.19	.01	.01	.30	-.16	-.05
13	.03	-.14	-.10	-.02	.00	.05	.07	.01	-.05	.11	-.24	-.08	-.20	-.24	-.18
14	.18	.29	-.02	-.00	-.07	-.12	-.10	.05	.24	-.17	-.08	-.18	.29	.15	-.14
15	-.13	-.10	.02	-.21	.06	.21	-.27	.06	-.33	.35	-.01	.15	-.29	-.08	.04
16	.11	.29	.15	.14	.00	-.10	.33	.18	-.12	-.03	-.15	-.16	-.00	.07	.13
17	-.35	-.22	-.07	-.16	-.03	-.07	-.02	.11	.22	.04	.12	-.10	-.01	.29	.05
18	.00	-.19	.13	-.09	-.09	-.05	.19	.00	.15	-.09	.09	-.10	.02	.10	.08
19	-.01	.02	-.18	-.00	.26	.01	-.07	.14	-.05	-.14	.21	.11	.22	.05	.10
20	.16	.16	.26	.10	-.14	.05	-.16	-.12	-.04	.08	-.28	.12	-.18	-.31	.05
21	.18	-.00	-.11	.10	-.09	.01	.16	.06	-.06	-.08	.04	-.14	.00	-.05	.11
22	.09	-.04	.01	.28	-.09	.16	.00	.08	-.03	.01	.11	-.06	-.15	-.18	.01
23	-.02	-.13	-.09	-.03	.07	-.01	-.04	-.01	-.08	-.10	.11	.05	.10	.26	-.21
24	.43	-.05	.04	-.10	-.00	-.08	-.31	-.21	-.03	-.09	.04	.03	-.02	.13	-.05
25	.28	.06	.30	-.21	-.11	.13	.06	-.08	.24	-.37	-.12	.09	-.15	.09	-.13
26	-.03	.19	.10	-.05	.11	.00	-.20	-.06	-.02	.02	.40	-.01	.01	.22	.13
27	.05	.04	-.03	-.17	.06	.03	-.07	-.02	-.11	-.34	.08	-.41	.22	-.27	-.06
28	.00	-.11	.01	.07	-.04	.00	-.10	-.18	.15	.13	-.11	.07	-.10	-.14	-.02
29	-.13	[illegible]	[illegible]	-.41	.06	[illegible]	.04	.06	[illegible]	.02	.06	.11	-.05	-.06	.16
30	.09	-.13	.11	.07	.07	.17	.14	.10	-.11	.06	.02	.20	-.01	-.17	.13
31	.11	-.00	.04	-.11	.12	.14	-.24	-.10	.27	.18	.10	.17	.05	-.21	.22
32	.17	-.11	.01	.13	-.05	-.12	.03	-.13	-.19	.15	.25	.09	.22	-.00	-.25
33	.15	.08	-.16	.10	.32	.07	-.01	-.02	-.19	.10	-.24	-.06	.04	-.05	.08
34	.10	-.15	-.22	.11	.13	-.14	-.15	.01	.20	.28	.22	.05	-.04	-.02	-.08
35.	.02	.39	.12	.21	.41	.14	.21	-.34	.00	-.05	-.08	.02	-.09	.10	-.11
36	-.07	.02	-.22	.24	.03	.06	-.02	.04	.16	.09	-.08	-.28	.03	.18	-.16
37	.09	-.10	-.03	.03	-.02	-.03	.03	.14	-.27	-.24	-.07	-.24	-.25	.13	.10
38	-.00	-.11	.37	.02	-.52	.01	.09	.37	.01	.08	-.25	.07	.16	-.22	.17

(Table 59 continues)

M_2 vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.18	-.77	.30	.38	-.48	-.35	.32	-.33	-.06	.62	-.37	-.63	-.38	-.46	.59
2	-.07	-.11	.08	-.31	-.04	-.25	-.08	.42	.30	-.12	-.17	.02	.21	-.07	.02
3	-.05	.01	.00	-.12	.00	-.24	.02	-.24	.12	.21	.02	.02	-.21	.52	-.15
4	-.21	-.00	.08	-.10	.05	-.03	.11	.05	-.10	-.09	.17	-.10	.08	-.16	-.54
5	.40	.15	-.21	.29	.02	.05	.29	.34	.12	-.35	-.42	-.05	-.09	.53	-.43
6	-.01	-.07	-.13	-.18	.46	.30	-.00	-.13	.06	.25	-.00	-.12	.02	-.05	-.03
7	.24	.19	.23	.20	.07	.27	-.02	.38	-.32	.14	-.02	.19	-.25	.10	-.07
8	.16	-.02	-.08	.22	-.01	-.06	-.25	-.16	.11	.05	-.09	.32	.25	-.10	-.31
9	.22	.07	-.32	-.10	.51	-.42	-.23	-.04	-.38	-.31	.22	.28	-.13	-.16	-.05
10	.61	.39	.54	-.23	-.01	.02	.22	-.33	.24	.10	-.20	-.04	.00	-.12	-.08
11	.12	-.10	.09	-.41	.08	.43	.45	.16	.02	-.03	.58	.54	.00	.27	-.03
12	.13	-.00	.10	-.31	-.12	.33	-.36	-.23	-.44	-.20	-.16	.07	.06	.15	.09
13	-.01	-.11	.16	.38	.21	-.23	-.37	.12	.47	-.28	.35	-.05	.20	-.01	-.02
14	-.24	.26	-.08	.10	-.00	-.11	-.00	.05	-.30	.21	.03	-.16	.71	.03	.06
15	.37	.24	-.55	-.15	-.44	.16	-.36	.34	.10	-.18	.16	-.11	-.16	-.13	-.01

Table 60. Canonical analysis, Boys, $N = 69$, $M_1 = 38$, $M_2 = 15$

	Eigenvalue	Rc	Lambda	Khi^2	NDF	p<
1	.96	.98	.00	826.35	570	.01
2	.94	.96	.00	679.52	518	.01
3	.90	.95	.00	560.89	468	.01
4	.85	.92	.00	460.70	420	.01
5	.81	.90	.00	380.32	374	.01
6	.75	.86	.00	308.82	330	.01
7	.71	.84	.00	250.10	288	.01
8	.69	.83	.00	197.72	248	.01
9	.57	.75	.02	147.91	210	
10	.53	.73	.06	112.38	174	
11	.48	.69	.14	80.35	140	
12	.39	.62	.28	52.48	108	
13	.30	.54	.46	31.71	78	
14	.23	.48	.67	16.59	50	
15	.12	.34	.87	5.48	24	

(Table 60 continues)

M$_1$ vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-.14	-.10	-.16	-.02	-.38	-.07	.13	-.17	.00	.29	-.11	.01	-.01	.15	-.22
2	-.03	.01	-.01	-.04	-.22	-.00	.06	.00	-.17	-.02	-.15	.09	-.06	.09	.12
3	-.05	-.25	-.15	.22	-.10	.12	.04	.08	.16	.01	-.04	.01	-.28	.41	-.03
4	-.12	-.08	-.11	-.16	.06	-.27	.01	.16	.10	-.02	-.15	.02	-.00	.02	.38
5	-.06	-.08	-.19	.07	.02	.19	-.26	-.11	-.15	-.09	-.11	.12	-.04	.00	-.05
6	-.13	-.19	.20	-.21	-.45	-.19	.02	-.08	-.13	.14	-.23	.04	-.17	-.05	.13
7	.51	.09	-.22	-.10	-.03	.12	.56	.06	.25	-.17	.16	-.02	-.02	.18	-.08
8	.25	.12	.27	-.10	.17	-.15	.15	-.10	-.08	.08	.39	-.05	.14	-.12	-.06
9	-.20	-.07	-.00	-.12	-.00	.01	-.10	.07	.07	.05	.17	-.21	.26	-.17	-.17
10	.29	-.08	.12	.28	-.33	.04	-.20	-.03	.04	-.35	.30	.06	-.16	-.09	-.08
11	.10	.34	-.01	.01	.05	.00	.14	.08	.16	-.03	.05	-.09	.23	-.16	-.26
12	.02	-.04	-.09	-.16	-.16	.06	-.24	-.11	-.02	.09	.07	.14	.16	.02	.24
13	-.11	-.14	.00	.04	-.21	.02	.26	.15	-.04	.14	.11	-.16	-.15	.11	.04
14	.20	.15	-.08	.28	.04	-.08	-.03	-.13	.13	.23	.24	-.37	-.05	.13	-.10
15	.11	.34	.02	-.00	.07	-.11	.12	.11	.00	-.16	-.16	.29	-.12	.05	.09
16	-.22	-.40	.23	-.13	.00	.11	-.12	-.05	.25	.00	-.26	-.04	.07	-.29	-.06
17	-.04	-.03	-.21	-.03	-.07	-.06	.09	.20	-.09	.16	.08	-.06	-.06	-.12	-.11
18	.05	-.00	.00	.11	.00	.06	-.24	.16	-.11	-.10	.05	.05	-.25	-.04	.07
19	.07	-.11	-.09	.14	-.04	-.10	.00	-.03	.21	.14	-.00	.15	.31	.16	.14
20	.05	-.10	-.05	.05	-.00	.22	-.05	.20	-.24	.02	.02	.01	-.11	-.15	.06
21	.05	-.09	.04	.11	-.02	-.26	-.10	.08	-.17	-.00	.04	-.04	-.04	.01	-.15
22	-.01	-.08	-.14	.03	.04	-.25	-.07	-.03	.00	-.05	-.13	-.22	-.03	.04	.16
23	-.07	-.07	-.00	-.00	-.04	.28	.11	-.06	.25	.13	.13	.02	-.01	.09	-.30
24	.26	-.05	.26	-.18	.14	-.32	-.01	-.17	-.12	.39	-.13	-.22	.06	-.22	-.05
25	-.08	-.01	.26	-.36	.12	-.09	.03	.19	.03	-.08	-.22	.07	.07	.10	-.00
26	-.07	.05	-.24	.20	-.08	.14	.23	-.43	.07	-.08	-.12	-.34	.06	-.06	.02
27	-.04	-.16	-.06	-.07	-.06	.02	.02	-.05	-.05	-.09	-.04	-.05	.01	.18	.33
28	.05	.04	-.31	.20	.35	.24	-.17	-.02	-.06	-.22	.00	.12	-.14	-.02	-.02
29	.11	.13	.03	.21	-.02	.16	.03	.03	-.13	-.05	.15	.35	.13	-.07	-.07
30	.04	.16	-.08	.08	-.17	-.16	-.05	.01	-.10	.35	-.19	.15	.09	.07	.00
31	.14	.00	-.03	.33	-.08	-.25	.19	-.39	-.50	-.01	.22	-.05	-.12	-.07	.17
32	.08	.20	.13	.06	-.12	.13	.07	-.03	.36	.10	-.04	.07	-.08	.19	-.24
33	.14	.03	-.03	.00	-.01	-.04	.00	-.19	-.00	-.21	.04	-.03	-.06	.16	-.16
34	.28	-.02	-.08	.23	.05	-.23	-.00	.10	-.00	.33	.33	.16	-.15	-.15	-.26
35	-.13	-.32	.24	-.22	.02	.15	-.09	.30	-.05	.00	-.07	-.28	.24	.14	.11
36	-.10	-.07	.05	.04	-.30	-.09	.06	.21	.07	.02	-.04	-.11	.10	-.04	.05
37	-.24	-.31	.16	-.17	.09	.06	-.16	.20	.14	-.02	-.07	-.12	.35	-.38	-.17
38	-.05	.01	-.35	.08	.09	-.18	.21	-.20	.05	-.07	.11	.23	-.36	.29	.12

(Table 60 continues)

M_2 vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.48	-.43	.80	-.41	-.25	.55	-.33	.03	-.30	-.17	.56	.28	-.46	-.56	-.28
2	-.03	.00	.00	.00	-.55	-.16	-.31	.07	.00	-.33	-.10	-.07	.20	.30	-.00
3	-.10	.10	-.14	-.03	.16	.35	.13	.05	.34	-.28	-.10	.18	-.29	.12	-.11
4	.11	-.05	.13	-.01	.06	.08	-.18	-.40	.17	.37	.27	.26	.13	.03	.00
5	-.06	.11	-.09	-.10	.17	-.20	.02	.07	.11	.42	-.21	-.50	.19	.17	-.67
6	.13	.37	-.23	.06	.07	-.12	-.01	-.40	-.09	-.18	.22	.00	.17	-.21	-.07
7	-.38	-.31	-.16	-.46	.20	-.25	-.05	-.04	-.11	-.06	-.05	-.26	-.03	.05	.22
8	.09	.06	-.27	.15	-.02	.21	.09	-.03	-.30	.42	-.08	.05	-.22	.24	.11
9	.19	.04	-.30	.18	.20	-.17	-.29	.55	.05	.03	-.15	.43	.18	.14	.05
10	.61	-.21	-.15	.45	.33	.26	-.03	-.02	.15	-.11	.16	-.34	.19	.30	.30
11	.20	.22	.00	-.01	.19	-.33	-.28	-.30	.03	-.12	-.58	.37	-.41	-.13	.33
12	-.14	-.58	.02	.26	-.33	-.07	.38	-.27	-.26	.12	-.12	-.05	.14	-.28	-.24
13	.15	.17	-.12	.22	.09	-.37	.16	.39	.26	.08	.23	-.04	-.28	.25	.02
14	.12	.21	.05	-.07	.08	.06	.49	-.09	-.40	-.34	.02	.04	.38	.30	.01
15	-.20	.15	-.05	-.45	-.44	-.01	.38	.05	.53	.24	.00	-.17	.15	-.23	.34

Table 61. Canonical analysis, Girls + Boys, N = 155, M_1 = 38, M_2 = 15

	Eigenvalue	Rc	Lambda	Chi^2	NDF	p<
1	.86	.93	.00	994.81	570	.01
2	.65	.81	.00	737.73	518	.01
3	.53	.73	.00	600.62	468	.01
4	.48	.69	.01	502.33	420	.01
5	.46	.68	.03	417.48	374	.01
6	.41	.64	.07	337.61	330	.01
7	.32	.56	.12	268.95	288	.01
8	.29	.54	.18	218.76	248	.01
9	.26	.51	.25	173.84	210	.01
10	.23	.48	.35	134.28	174	
11	.21	.46	.45	100.67	140	
12	.20	.45	.58	69.49	108	
13	.15	.39	.73	40.19	78	
14	.09	.31	.86	18.24	50	
15	.03	.19	.96	5.06	24	

(Table 61 continues)

M_1 vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.04	-.00	-.03	-.09	-.12	-.03	-.00	.01	.06	-.23	.09	.23	.02	.08	.18
2	-.28	-.17	-.08	-.08	-.01	.18	-.02	.14	-.19	-.04	.23	-.07	-.10	.10	.15
3	-.12	.02	.09	-.11	-.15	-.08	.13	-.01	-.06	.02	.19	.01	.07	.22	.11
4	-.05	.18	-.07	-.08	-.26	.28	-.01	.09	-.09	-.06	.18	-.09	-.10	-.12	.14
5	-.04	.02	-.28	-.07	-.06	-.26	.06	.02	-.03	-.33	-.00	-.18	-.11	-.02	.07
6	.05	-.20	-.16	.00	-.15	-.12	.17	-.12	-.13	-.03	-.04	-.08	-.05	.09	.04
7	.61	-.07	.41	.02	.02	-.15	-.34	.26	.13	.31	-.06	.15	.35	.06	.005
8	.11	.17	.04	.22	.06	-.07	-.07	-.10	.19	.46	-.08	.37	.01	-.15	.08
9	-.06	-.19	.09	-.51	-.15	-.00	.05	-.09	-.05	.04	-.08	.08	.10	.08	-.12
10	.18	-.13	-.53	.04	.10	-.16	-.11	-.12	-.37	.11	-.13	.07	.05	-.26	.22
11	.16	-.18	.04	.08	.18	.25	-.05	-.17	.03	.01	-.14	.00	.03	-.38	.05
12	.16	-.13	-.03	-.01	-.28	-.01	.03	-.18	.15	-.21	.31	.09	-.36	.08	-.10
13	-.06	-.05	.10	-.05	-.11	-.17	.21	.25	-.03	.14	.12	-.01	.24	-.02	.12
14	.09	-.12	.21	-.14	.14	.08	.20	.00	-.15	-.02	.10	.36	-.03	.27	-.17
15	-.03	-.15	.03	.06	-.10	.18	-.17	-.02	.23	.13	-.27	-.20	.01	-.10	.26
16	.05	.26	-.13	.10	.21	.06	-.23	-.27	-.35	-.14	.09	.02	.03	-.10	-.00
17	-.05	-.17	.02	-.27	-.24	-.10	.06	.18	-.05	.08	-.13	-.19	-.00	.06	.12
18	-.03	.00	-.25	.14	.02	-.15	.02	.10	-.06	-.17	-.21	.06	-.07	-.18	-.06
19	.05	-.07	-.10	-.00	-.05	.33	-.15	-.21	.32	.07	.12	-.04	.01	.17	.37
20	.04	.18	.12	-.09	.13	-.37	-.04	.32	-.09	.03	.02	.01	-.24	-.20	-.18
21	.04	.03	-.13	.06	-.17	-.02	.04	-.00	-.11	.25	.10	.05	-.04	-.10	-.13
22	-.02	-.04	.03	.08	-.16	.12	.30	-.04	-.10	-.02	.06	-.06	.06	-.15	-.04
23	-.08	.04	.08	.16	-.10	-.16	-.11	-.12	.02	.00	.06	0.01	.06	.22	-.06
24	.48	.09	-.02	.17	.08	-.01	.01	.02	-.02	-.11	.03	-.13	-.12	.10	-.03
25	.07	.27	.09	-.05	.10	.10	.02	-.28	-.11	-.10	-.01	-.10	-.07	.02	.10
26	.11	-.03	.23	-.03	.12	.21	.03	.21	-.13	-.08	-.17	.15	-.03	.10	-.10
27	.07	.20	-.07	-.17	.04	.23	-.17	-.09	.06	-.04	.13	.10	.16	.10	-.23
28	-.05	.00	.06	.09	.07	-.16	.20	.21	.09	-.15	-.23	-.14	-.09	.13	-.23
29	-.05	-.08	-.13	-.21	.19	.11	-.38	.12	.02	.25	.14	-.10	-.29	-.02	.09
30	.03	-.25	-.22	.14	.08	.15	.28	-.02	.27	.00	.08	-.17	-.05	.12	-.17
31	.04	-.14	.11	-.01	-.06	.22	.12	.34	.10	-.11	.12	.12	.04	-.29	-.24
32	.19	-.08	-.08	.38	.10	-.02	.06	-.03	.13	-.02	-.14	.40	-.04	.21	.23
33	.17	-.06	-.11	-.16	.06	-.02	-.02	.06	.06	-.07	.13	.06	.43	-.13	.11
34	.12	-.05	-.00	-.16	-.26	-.00	.13	-.06	.23	.12	-.28	-.04	-.19	-.21	.19
35	.08	.38	.14	-.26	.29	-.12	.25	-.14	-.04	.16	.44	-.09	.23	-.07	.10
36	-.05	-.21	.03	.12	.01	.07	.12	.09	-.24	.13	-.02	-.03	.15	.13	.17
37	-.07	.30	-.10	.02	-.24	-.06	-.24	-.22	-.20	.21	.03	-.35	.18	-.09	-.29
38	-.06	.18	-.01	-.13	-.37	.07	.04	.13	.15	-.13	-.16	.15	-.18	.23	-.04

(Table 61 continues)

M_2 vectors

VAR/VEC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.44	.27	-.57	.65	.00	-.82	-.21	.13	-.39	.30	-.39	.22	.37	-.45	-.57
2	.09	-.32	-.29	-.21	.11	.04	-.16	-.04	-.20	.05	.21	.32	-.05	-.00	.14
3	.02	-.00	.10	-.02	.11	-.11	-.12	-.04	-.02	-.08	-.52	.01	.03	.27	.31
4	-.01	.06	-.13	.12	-.03	-.03	-.06	-.41	.28	-.06	.08	.13	-.05	.31	-.22
5	.03	-.08	.20	-.15	-.12	-.11	.42	-.38	-.23	-.12	.43	-.22	.38	.42	.26
6	.08	-.27	-.12	-.16	-.02	.21	.08	.13	.27	-.25	-.15	-.12	.33	.03	-.19
7	-.04	.33	.13	-.31	-.37	[illegible]	.10	-.14	.02	-.33	.06	-.06	-.04	-.33	.06
8	.06	-.05	.12	-.04	.00	-.14	.28	.44	.26	-.17	.11	.11	-.26	.19	.15
9	.24	-.10	-.17	-.31	.01	.08	-.22	.00	.47	.41	-.05	-.48	-.33	.16	.22
10	.76	.40	.19	-.32	.71	.13	.21	-.11	-.01	-.19	-.03	.25	-.04	.06	-.16
11	.26	-.18	-.18	.38	-.07	.31	.03	-.24	.20	-.41	-.13	-.40	-.39	-.38	.44
12	.20	.34	.00	.01	-.20	.14	-.31	.52	-.26	-.14	.37	-.19	.01	.21	-.10
13	-.06	.02	-.11	-.03	-.20	.23	.51	-.00	.06	.48	-.24	.25	-.15	.14	.12
14	.00	.09	.29	-.00	.15	.09	-.35	.18	.30	.17	.25	.40	.37	-.18	.07
15	.10	-.51	.51	-.01	-.42	.13	-.18	-.19	-.29	.06	.03	.10	-.29	.05	-.25

A glance at the weights of the canonical vectors reveals that the signs of the weights are affected by multicollinearity. This phenomenon comes about in such a way that, when the equilibrium condition is being determined, strongly intercorrelated variables behave in the construction of the variants corresponding to each other in such a way that the signs are changed.What isconcerned is the underdeterminateness of the normal equations. This phenomenon is apparent in the example provided by Cooley and Lohnes (p. 45), for instance, although the authors have not commented on it. In the present study, however, multicollinearity is able to be kept in control, as the correlation matrices for the variables are available. Nevertheless, the information contained in these matrices is not sufficient. Yet, the factor loadings obtained by factor analysis furnish information on the basis of which it is possible to interpret the signs in canonical analysis appropriately. Thus, the factor analyses, at the same time as they serve other purposes, are of aid in the interpretation of the signs of the weights yielded by the canonical analysis. The interpretation of the vector pairs is rendered comparatively complicated by multicollinearity and the large number of variables. Also, the information contained in the correlation matrices and the matrices yielded by factor analysis will be drawn on. Although "explanation" will be spoken of in the description of the connections between the vectors, this must not be understood in a causal sense, but only as indicating relationships as revealed by the model. Eight pairs of significantly interrelated vectors ($p < .01$) are obtained for the girl groups. These are as follows:

1st vector pair: handcrafts, civics, book-keeping, physical education and the mean of the marks are explained by the attitudes towards mother, attitudes towards father, and change gipsies, and by a few verbal ability variables.

2nd vector pair: carefulness, handcrafts and drawing are explained by leadership, numerical ability variables and S6/K.

3rd vector pair: the mean of the marks and handcrafts are explained by the number of siblings, attitudes towards father, and certain intelligence variables.

4th vector pair: vocational guid. and penmanship are explained by ornament test and attitudes towards teachers.

5th vector pair: physical education, arithmetic and carefulness are explained by the number of siblings, leadership, emotional balance, the picture test and the number cancelling test.

6th vector pair: physical education, music and a number of theoretical subjects are explained by several intelligence variables.

7th vector pair: the school subject vector, which involves a number of theoretical and practical subjects, is explained by certain intelligence variables, change Sibelius,

attitudes towards mother and attitudes towards other people.
8th vector pair: religion, civics and book-keeping are explained by verbal, reasoning and visual ability variables, leadership and the number of siblings.

Eight canonical correlations which are significant at least at the .01 level are obtained for the boy group:
1st vector pair: handcrafts and book-keeping are explained by verbal and visual ability variables, activity, the attitudes towards the mother and the Sibelius variable.
2nd vector pair: music and carefulness are explained by the Sibelius variable, several intelligence variables and leadership.
3rd vector pair: practical subjects and carefulness are explained by the attitude variables and the teacher rating variables.
4th vector pair: book-keeping, handcrafts and the mean are explained by intelligence variables, attitudes towards the father and attitudes towards other people.
5th vector pair: religion and the mean are explained by a number of intelligence variables.
6th vector pair: reading (and literature), vocational guidance and penmanship are explained by several attitude variables.
7th vector pair: practical subjects and theoretical subjects are explained by a number of intelligence variables.
8th vector pair: a number of theoretical and practical subjects are explained by leadership and attitudes towards other people.

Nine canonical correlations which are significant at least at the .01 level are obtained for the combined group. No interpretation of the separate vector pairs will, however, be undertaken here.

It was found that the programme employed resulted in interpretational problems of a kind that suggested revisions in the programme. As a matter of fact, a revised canonical programme of a desirable kind drawn up by Nummi. This will be described only in connection with the factor-level canonical analysis, since time did not permit programming it for a computer large enough for the variable level analysis.

The canonical analyses permit the following conclusions:
1. Of the canonical correlations between pairs of vectors, 8 for the girl group, 8 for the boy group and 9 for the combined group are significant at least at the .01 risk level.
2. By employing the maximized a and b coefficients it is possible to interpret vectors corresponding to one another. Inspection of these vectors suggests that canonical analysis does not provide an effective means for the condensation of information. In the case of a heterogeneous battery like the present one, the vector pairs indicate the sets of variables that are associated with the various school achievement vectors obtained. By means of the a and b coefficients of the vectors corresponding to each other it is possible to obtain rather detailed information as to which of the variables considered as independent are associated with the school achievement variables, considered as dependent in this study. The magnitudes and signs of the a and b coefficients raise interpretational problems in canonical analysis.
3. The interpretation of the results is complicated by the interrelations of the variables within the various sets (multicollinearity). However, utilization of correlations and factor analysis made it possible to master the situation.

4. The number of variables included in the canonical analyses is comparatively large. In consequence, the available information is so plentiful as to make it difficult to interpret the content of the interrelations in concise form. Thus there is reason to combine variables and to subject the resulting smaller set of variables to canonical analysis. The operations to be described in the following section in fact serve this purpose: an attempt will be made to reduce the dimensionality of the variables and to diminish the interrelations within the various sets of variables.

The factual information furnished by the canonical analyses will be summarized in the section summarizing the results of the entire study (Part IV).

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Appendix 1. The number of lessons in each subject (eighth grade).

	General course		Commercial course		Technical course	Hardcrafts-home econ. course
	G.	B.	G.	B.	Boys	Girls
Religion	1	1	1	1	1	1
Civics	4	4	2	2	4	4
Reading and literature	2	2	2	2	2	2
Composition	2	2	2	2	2	2
Home economics	5	1	4	1	1	9
Child care	1	1	1		1	1
Mathematics	4	4	3	3	3	3
Natural sciences		2			4	
Hygienics	1					1
Drawing	1					
Music	2					1
Physical education	2	2	2	2	2	2
Professional drawing		2			2	
Handcrafts	4					9
Woodwork		4			6	
Metalwork		4		4	6	
Book-keeping	2	2	3	3	2	1
Typewriting	2	2	2	2		
Printing			2	2		
Swedish			3	3		
Theory of commerce			3	3		
Commercial geography			2	2		
Business correspondence			1	1		
English or Swedish	2	2	2	2		

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